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The Impact of "Poverty Alleviation" on the Income of Urban and Rural Residents in State-Level Impoverished Counties: Evidence from China

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Abstract

Due to the differences in the national conditions of different countries, the effectiveness of the exit mechanism of impoverished areas in other countries is still controversial. Therefore, based on the data of 832 state-level impoverished counties in China from 2013 to 2020, the research goal of this paper is to apply the Staggered DlD method to study the impact effect and mechanism of poverty alleviation in national impoverished counties on the income of urban and rural residents, which is of great significance to stimulate the income increase of impoverished The population. The results indicate that: (1) With the support of positive incentive policies and sound exit mechanisms, after poverty alleviation, the two-way fixed effect model shows that the income of urban and rural residents in China's poverty alleviation counties has a significant growth effect. (2) In addition, there is regional heterogeneity in the growth effect of urban and rural residents' income in impoverished counties, which generally presents the differentiation pattern of "high at the eastern and western ends, low in the middle" and "high in the south, low in the north". (3) Further analysis using the generalized synthetic control method confirms the effectiveness of the poverty alleviation policy. (4) The influence mechanism of poverty alleviation on urban and rural residents' income is heterogeneous, in which levels of agricultural mechanization, education, social welfare, and local financial hematopoietic capacity have significant promotion effects on the income of urban and rural residents in impoverished counties. The research in this paper not only enriches the research content and realistic path of consolidating China's poverty alleviation achievements but also makes certain theoretical and practical contributions to the revitalization and development of China's once-impoverished countries.

Keywords

Poverty Alleviation; The Income of Urban and Rural Residents; The Staggered DID Method

Introduction

Governments of all countries have paid great attention to the problem of poverty alleviation, and "poverty elimination" has become the first goal of sustainable development [1-3]. This is also a development issue that mankind needs to face together because poverty eradication can not only enable people to live a happy life and promote global economic growth, but also help reduce regional development inequality and social unrest.

In 1986, China established 331 impoverished counties for the first time. In the first few years of poverty alleviation, it was a disgraceful thing to join impoverished counties. However, as time goes by, there is a phenomenon that people do not want to get rid of poverty after joining impoverished counties. The main reason is that the impoverished counties will bring many financial benefits and policy preferences, so it is impossible to take the initiative to apply for poverty alleviation of impoverished counties. In 2016, the Opinions on Establishing a Poverty Exit Mechanism established the exit mechanism of the poor population, and the state-level impoverished counties established a poverty exit mechanism in accordance with local conditions, including the introduction of various incentive mechanisms, mainly including

the “incentive policy”, “poverty relief policies continue after counties being removed from poverty list" and “stimulating the enthusiasm of cadres” and other positive incentive policies. In the targeted poverty alleviation stage, that is, from 2017 to 2020, 31 impoverished counties in China have been lifted out of poverty, 125, 302 and 374. China has won the battle against poverty.

Although all these areas have been lifted out of poverty with the support of national policies, if they are affected by external uncertainties, the achievements made in poverty alleviation may be wasted. The existing research literature mostly focuses on the impact of specific poverty alleviation policies on economic development or people's income in the past, but lacks research on the effectiveness of exit mechanism in impoverished areas. Therefore, the purpose of this paper is to explore whether the transformation from “impoverished county” to “impoverished county” really brings about an increase in income level for poor people, and explore the ways to increase income level.

Based on the above questions, this paper uses the Staggered DID method to study the impact of “poverty alleviation” in state-level impoverished counties on the income of urban and rural residents. The Staggered DID method is used for this research mainly because it is widely used in the study of effect evaluation, and this method can effectively avoid endogenous problems, and only needs to meet the preconditions such as parallel trend hypothesis and placebo test. This paper further studies the inter-annual impact effect by using the generalized synthetic control method. This method is not only suitable for implementing policies at different places and time, but also relaxes the assumption of parallel trend, which can more accurately detect the average treatment effect and interannual impact effect of policies, which is convenient for policy makers and implementers to better adjust and supplement policies. Then, this paper further clarifies the mechanism of agricultural mechanization level, industrial development level, education level, medical level, social welfare level and local fiscal capacity in the income increase of urban and rural residents in impoverished counties. Finally, on this basis, it reveals the corresponding policy implications.

The main contribution of this paper is to build an analysis framework of the impact of poverty alleviation on the income of urban and rural residents in impoverished counties according to the corresponding theoretical basis, and take poverty alleviation policy as a quasi-natural experiment, study the effectiveness of the exit mechanism in impoverished areas, and discuss its mechanism in detail. The research in this paper not only enriches the research content and realistic path of consolidating China's poverty alleviation achievements, but also contributes to the revitalization and development of China's poverty alleviation counties.

The remainder of this study is arranged as follows: Section 2 provides theoretical analysis and research hypotheses, Section 3 presents the study design, Section 4 reports empirical results and discussion, Section 5 reports quantitative results for further analysis using the generalized synthetic control method, Section 6 studies the pathway of the mechanism of action, and Section 7 summarizes the study conclusions with policy recommendations.

Theoretical Analysis and Hypothesis

Based on the theory of policy evaluation, this paper studies the effectiveness of the poverty exit mechanism. This paper also puts other theoretical analysis through the logical analysis of “poverty alleviation” to promote the income increase of urban and rural residents in nationally impoverished counties.

The title of impoverished counties can bring poverty alleviation resources and preferential policies. While solving the poverty problem, it also leads to “Welfare dependence” for poor people. Impoverished people will have dependence psychology and behavior on policies that bring relevant stable benefits to themselves when they are out of poverty, weakness and inferiority psychology [4]. The sudden withdrawal of policies may lead to disadvantages caused by policy dependence. “Welfare dependence” means that more “slackers” rely on welfare relief for their lives, which not only wastes the relief resources but also brings financial pressure to local governments [5]. Social welfare relief policies lead to the decline of the employment willingness and labor enthusiasm of the poor, making the poor overly dependent on the relief of local governments for survival, leading to the poor becoming even poorer [6-8]. There is also evidence that the duration of welfare collection is related to dependence [9]. Another view is that there is no “welfare dependence” in the relief policy, nor does it bring about the problems of “slackers” and declining employment enthusiasm [10]. In the research on national impoverished county policies, the establishment of impoverished countries to obtain financial transfer payments has positive significance for the economic development of impoverished areas and the reduction of poverty incidence [11]. China’s poverty alleviation policy has not only increased the GDP of counties in concentrated contiguous impoverished areas but also increased the growth rate of per capita resident deposit balances in counties to a certain extent [12]. Therefore, many scholars believe that to solve the problem of negative exit in impoverished counties, it is necessary to establish and improve the assessment standards, exit system, and exit mechanism because impoverished counties are over-reliant on government resources [13]. Zhang Qi and Shi Zhile pointed out that to establish a motivation mechanism and compensation mechanism for impoverished countries to withdraw, first find out the reasons and problems of insufficient motivation in impoverished countries to withdraw, and secondly, establish an attractive compensation mechanism to stimulate impoverished counties to withdraw motivation [14]. In addition, the poverty exit mechanism should also include a risk prevention mechanism, incentive and restraint mechanism, and third-party evaluation mechanism [15].

By the end of 2020, all 832 impoverished counties across the country were lifted out of poverty and have become history, but this does not indicate the end of poverty alleviation work. The theory of circular cumulative causality put forward by Murdahl shows that if there is no policy intervention to reduce income inequality, then poverty will form a circular cumulative trend. Therefore, in order to further put an end to returning to poverty and link the effective development of once-impoverished counties, the government issued the Opinions of the Central Committee of the Communist Party of China and the State Council on Realizing the Effective Connection

between Consolidating and Expanding Poverty Alleviation Achievements and Rural Revitalization, and put forward relevant implementation opinions on consolidating poverty alleviation achievements from the aspects of characteristic industry development, people's basic livelihood, education and health. As external factors and internal factors jointly determine the development of things, among the external factors, the withdrawal mechanism, assistance measures, safeguard policies, and incentive mechanisms can stimulate the endogenous development power of the once-impoverished county. The internal factors are mainly to enhance the "hematopoiesis" ability of the county by improving the level of agricultural mechanization and industrial development, and these measures can promote the income increase of the poor [16, 17]. In addition, measures such as improving education level, social welfare level, and local financial hematopoietic capacity are also the "internal causes" of to increase in the income of urban and rural residents in the county.

The theory of the big-push big-push big push and the theory of the low-level equilibrium trap show that government investment can change the backward situation of impoverished areas without falling into the low-level trap, and investment can achieve the role of poverty reduction by increasing the income of poor people. These two theories constitute the theoretical basis of poverty reduction policy. In addition, the incentive principle shows that the withdrawal mechanism of nationally impoverished counties should be established, to form positive incentives and promote the income increase of urban and rural residents in unhat counties. to consolidate the achievements of poverty alleviation and promote rural revitalization, the Opinions on Establishing Poverty Exit Mechanism was issued in April 2016. The government established the exit mechanism for the first time and defined the exit criteria. Positive incentive policies and safeguard measures such as timely poverty alleviation better stimulated the endogenous development momentum of impoverished counties, thus promoting the development of the county. First of all, in order to ensure stable poverty alleviation, the policy of poverty alleviation and not relaxing the supervision for a period of time, leaving a buffer period for the development of impoverished counties, and solving the problem of maladjustment caused by the sudden withdrawal of policies. For example, the poverty alleviation funds given by the local government of Guizhou Province to the county have increased year by year by 10% on the basis of the previous three years' funds [18]. Therefore, impoverished countries are scrambling to get out of poverty. Secondly, some special financial poverty alleviation funds should be used to encourage impoverished counties and mobilize their own development enthusiasm. For example, Hebei Province gives high bonuses to impoverished counties that get rid of poverty on time and gives notification and praise. Guizhou Province issued a "poverty reduction reward" and "poverty elimination reward", and awarded 10 million funds to the impoverished counties for getting out of poverty [18]. Sichuan Province will directly reward Cangxi County, Wangcang County, and Jiange County with good assessment results with 10 million yuan. Third, commend and reward leading cadres with outstanding performance, to stimulate the consciousness of local cadres to lead the development of impoverished areas. For example, high bonuses and provincial praise are given to local government leaders in the county, and priority is given to promotion and reuse [19]. Among them, Guizhou Province directly rewarded 500,000 to the leadership teams of impoverished counties that get out of poverty on time [20]. Finally, the special restrictions on impoverished counties will be canceled, and the evaluation of impoverished counties will be canceled, so that the once-impoverished counties will enter the rural revitalization with a brand-new attitude.

In the process of poverty alleviation in nationally impoverished counties, local governments and staff will play games and interact with impoverished groups around the benefits brought by policies. Local governments and staff will make behavior choices based on achievements, while impoverished groups will make path choices based on interests. After the game and interaction between the two sides, the impoverished groups will judge whether they can get benefits. After the nationally impoverished countries are lifted out of poverty according to the standard of "four rates and one degree", the policy of poverty alleviation means that new policies such as replacing subsidies with awards, commendations, and rewards are immediately implemented on the basis of the original policies, and the leading bodies and cadres who have getting out of poverty are rewarded and reused, leaving a buffer period for consolidating the achievements of poverty alleviation. The theory of public finance shows that various resources can be introduced into poor areas through government policy intervention, so as to increase the income of impoverished groups. Therefore, the new policy provides restricted and conditional assistance to the impoverished groups, so based on the principle of maximizing interests, the impoverished groups will mobilize their enthusiasm and initiative to get rich by receiving restricted and conditional assistance, so as to get rid of the poverty culture and move towards the culture of getting rich. Under this positive encouragement, efforts will be made to stimulate the impoverished groups to achieve self-development and self-creation. Poverty vulnerability theory points out that poverty is mainly reflected in the lack of material resources, medical and educational resources. Therefore, the poor need to improve the level of education, medical care and social security to get rid of poverty. The traditional theory of agricultural transformation points out that by increasing the scientific and technological content of agriculture to improve the benefits of agriculture, it is beneficial to increase the income of impoverished groups. Therefore, new policies such as replacing subsidies with awards have improved the endogenous development power of the county by improving the level of agricultural mechanization, industrial development, education, medical care, and social welfare, so as to improve the income level of urban and rural residents in the county. The theoretical analysis framework diagram constructed in this study is shown in Figure 1, and the logical relationship between poverty alleviation affecting the income of urban and rural residents in nationally impoverished counties is shown in Figure 2.

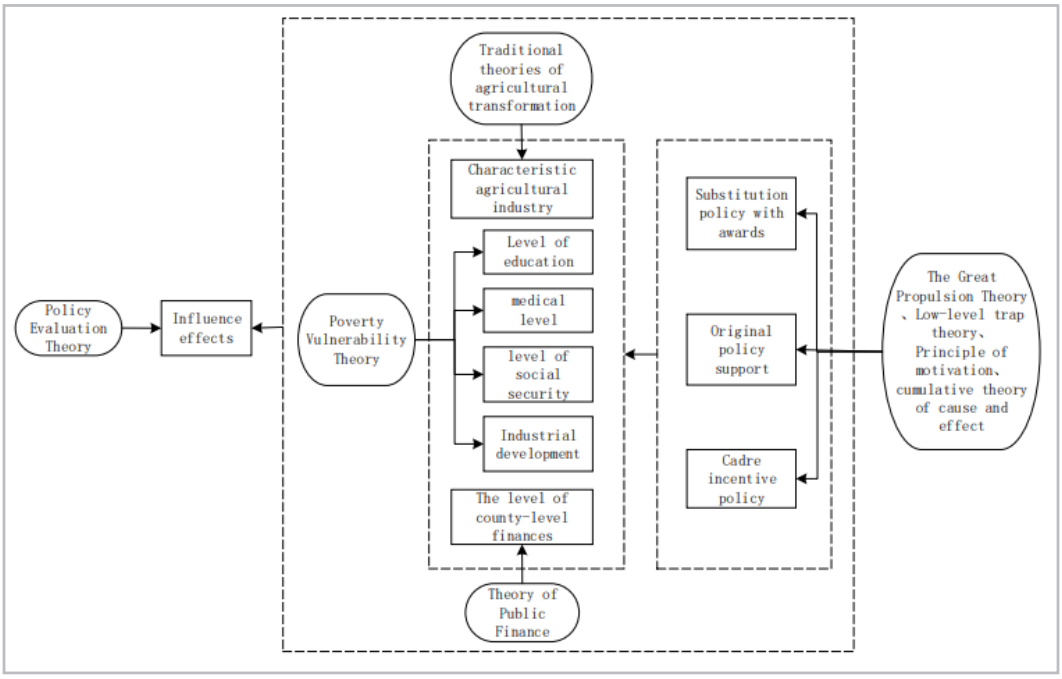

Figure 1: Theoretical analysis framework of poverty alleviation affecting the income of urban and rural residents in national impoverished counties

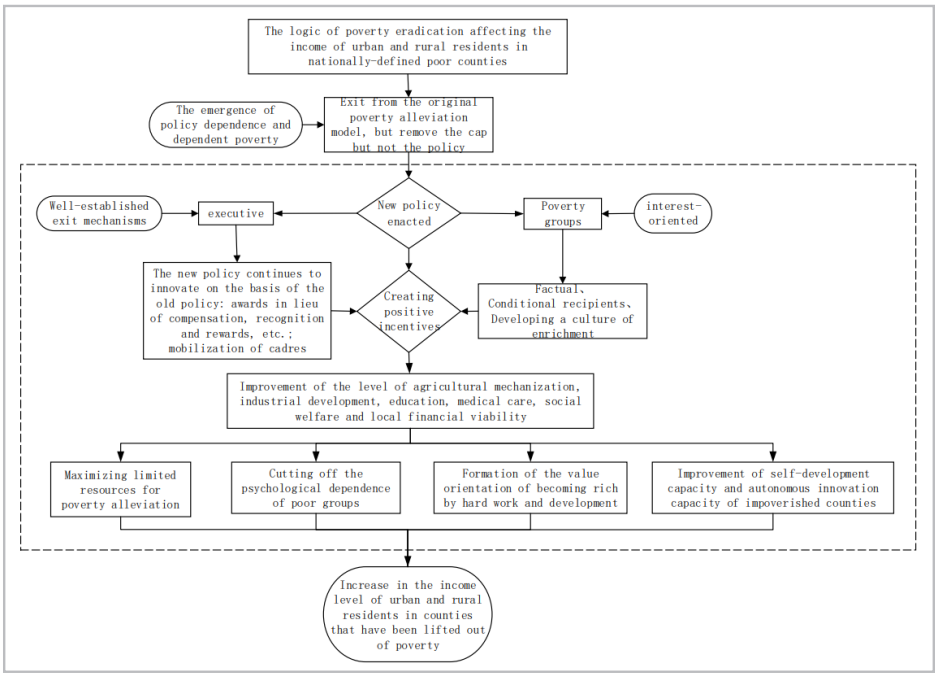

Figure 2: Logical relationship diagram of poverty alleviation affecting the income of urban and rural residents in national impoverished counties

Building Upon the Aforementioned Analysis, We Propose our First Research Hypothesis

Hypothesis 1: With the support of the perfect exit mechanism and positive incentive measures, poverty alleviation has a promoting effect on the growth of urban and rural residents' income in state-level impoverished counties.

This paper studies the literature on the path of promoting residents' income in poverty alleviation policy, aiming to lay a foundation for the subsequent analysis of the mechanism of poverty alleviation on the income of urban and rural residents in state-level impoverished counties. New agricultural technology has a significant impact on reducing the poverty population and improving economic surplus [21]. Among them, the improvement of agricultural mechanization level has a significant promoting effect on farmers' income [22]. Industrial poverty alleviation is an important part of China's targeted poverty alleviation policy, which has achieved remarkable results in promoting pov-

erty alleviation reform pilot areas [23]. Shi and Zhu point out that the targeted poverty alleviation policy of industry can help the poor out of poverty, and the diversification of poverty alleviation policies can optimize the resource allocation of the poor [24]. The research on basic public services and resident income increase mainly includes the research on infrastructure construction, education, medical treatment and resident income increase. The research reveals that rural infrastructure construction has a significantly positive effect on poverty reduction [25]. It can help the poor out of poverty through knowledge, resources, and opportunities [26]. Medical investment can improve productivity, and the development of the health sector can bring economic growth and reduce the occurrence of poverty [27]. Building upon this premise, we present the following hypothesis:

Hypothesis 2: Intermediary factors such as the level of agricultural mechanization, education, social welfare and local finance capacity promote the growth of urban and rural residents' income in impoverished counties to varying degrees.

Research Design

Data and Variable Setting

The data used in this paper are from the Statistical Yearbook of China's Counties, Statistical Communiques on National Economic and Social Development of Counties, Statistical Yearbooks of various provinces and cities, and EPS database. It eliminates some abnormal data and then uses an interpolation method to process the data. In 2012, the list of impoverished counties in China was adjusted, and the per capita net income of farmers was changed to the per capita disposable income of farmers. Therefore, to avoid the impact of the list adjustment and the change of data caliber on the research results, this paper selects 2013-2020 as the observation period. By 2020, a total of 832 counties have been lifted out of poverty. Due to the lack of data in 10 counties, including Ningxian County, Xingtang County, Xuanhua District, Shangrao County, Dachaidan Committee, Lenghu Committee, Mangya Committee, Kelan County, Bailang County and Shuanghu County, this paper takes 822 impoverished counties as research samples.

According to Fan Yanli's research, this paper sets variables based on the availability of data, and sets explained variables as the income of rural residents and urban residents in impoverished counties, which are expressed by the per capita disposable income of farmers and urban residents in impoverished counties [28]. To eliminate the influence of price factors, the income of rural residents and urban residents in impoverished counties will be reduced to constant prices in 2013 according to the corresponding provincial consumer price index (CPI). Based on the research of the above scholars, this paper selects the control variables as population size, industrial structure, savings level, financial loans, and fiscal expenditure. The meaning and calculation of the variables are shown in Table 1, and the specific descriptive statistics of the variables are shown in Table 2.

Table 1: Meaning and calculation of the variables

variables	Meaning of variables	Calculation of the variables
moneycpiw	Income of rural residents	Per capita disposable income of rural residents
citymcpiw	Income of urban residents	Per capita disposable income of urban residents
did	Whether to lift out of poverty	The value after poverty alleviation is 1 and the rest is 0
pop	Population size	Logarithm of the total population at the end of the year in the poverty-alleviation county
second	industrial structure	Total output value of the secondary industry/GDP
third	industrial structure	Total output value of the tertiary industry/GDP
save	Savings level	Balance of savings deposits of urban and rural residents/GDP
loan	Financial loans	Balance of loans of financial institutions at the end of the year/GDP
exp	Fiscal expenditure	General public budget expenditure/GDP

Table 2: Descriptive statistical table of 822 counties lifted out of poverty

Variable	Observation value	Average	Standard deviation	Minimum value	Maximum value
moneycpiw	6576	0.838	0.244	0.218	2.336
citymcpiw	6576	2.322	0.434	0.728	3.774
did	6576	0.220	0.415	0.000	1.000
pop	6576	4.110	0.978	0.693	6.111
second	6576	0.351	0.147	0.013	0.896
third	6576	0.416	0.120	0.061	0.864
save	6576	0.855	0.427	0.006	3.329
loan	6576	0.772	0.464	0.0003	5.790
exp	6576	0.543	0.442	0.005	5.432

Setting of the Impact Assessment Model

The principle of DID method is to explain the policy effect by constructing a "treatment group" with policies and a "control group" without policy treatment, and comparing the differences between the treatment group and the control group before and after the policy occurs. However, in the process of multi-time

[1]The population has negative values after taking the logarithm, and it is added 1 to become positive without changing the research results and significance level.

and multi-location policy implementation, there are differences in the time when the research objects are "processed", and the policy is gradually promoted in many places, which requires the gradual double difference method for evaluation. Therefore, this paper uses the gradual double difference method to study the impact of "poverty alleviation and poverty alleviation" in national impoverished counties on the income of urban and rural residents. Staggered DID method is widely used in the research of policy effect assessment, which can be applied to policy evaluation scenarios of multiple time points and locations and can effectively avoid endogeneity problems [29]. Different from the establishment of impoverished counties, the "poverty alleviation" of state-level impoverished counties adopts the third-party evaluation to solve the problem of self-selection of samples. In addition, the poverty alleviation standard is not determined by the income level of the residents of state-level impoverished counties, but by the comprehensive index determined by the "poverty incidence, the wrong drop rate of the impoverished population, the omission rate of the poor population and the public recognition", thus solving the problem of mutual causality. From 2017 to 2020, 31 impoverished counties in China have been lifted, 125 impoverished counties, 302 impoverished counties and 374 impoverished counties . This paper regards the poverty alleviation as a quasi-natural experiment, and sets Model (1) and Model (2) to estimate the change law of the income of rural residents and urban residents in state-level impoverished counties before and after the poverty alleviation.

$$moneycpiw_{ct} = \alpha + \beta_1 did_{ct} + \beta_2 control_{ct} + \gamma_c + \delta_t + \varepsilon_{ct} \quad (1)$$

$$citymcpiw_{ct} = \alpha + \beta_3 did_{ct} + \beta_4 control_{ct} + \gamma_c + \delta_t + \varepsilon_{ct} \quad (2)$$

If the state-level impoverished county c is lifted out of poverty in t year, then the state-level impoverished county c is in t year and the years after , otherwise it is 0. represents the income of rural residents in the state-level impoverished county c in t year, represents the income of urban residents in the state-level impoverished county c in t year. represents the control variable, controls the county-level regional fixed effect, controls the time fixed effect, and represents the error term. Empirical results and discussion.

Empirical Results and Discussion

Benchmark Regression Results

Table 3 shows the research results of the impact of the "lifting out of poverty" in the state-level impoverished county on farmers' income. Column (1)-(6) respectively represent the estimation results without control variables, with control variables, regional fixed effect and time fixed effect, and also include control time fixed effect, regional fixed effect and high-dimensional fixed effect. The estimated coefficient of the effect of "lifting out of poverty" on farmers' income in national impoverished counties is positive at the significance level of 1%, which indicates that farmers' income in national impoverished counties has indeed increased poverty alleviation. However, with the addition of different fixed effects, the estimation coefficients of columns (1)-(6) show a decreasing trend. Table 4 shows the research results of the impact of "poverty alleviation" in state-level impoverished counties on the income of urban residents. The significance level of the estimated results of columns (1) to (6) is 0.01, indicating that the "poverty alleviation" in state-level impoverished counties does have a significant promoting effect on the income of urban residents.

Table 3: Effect of poverty alleviation on farmers' income in state-level impoverished counties

Variables	(1)	(2)	(3)	(4)	(5)	(6)
did	0.277***	0.207***	0.203***	0.028***	0.029***	0.024***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
pop		0.014**	0.048***	0.001	0.035***	0.070***
		(0.006)	(0.007)	(0.005)	(0.006)	(0.018)
secod		0.429***	0.467***	-0.058**	-0.037	-0.104***
		(0.036)	(0.035)	(0.026)	(0.025)	(0.035)
third		1.040***	1.065***	0.046	0.070**	0.058
		(0.040)	(0.039)	(0.030)	(0.030)	(0.041)
save		0.045***	0.089***	-0.021***	0.001	-0.005
		(0.01)	(0.010)	(0.006)	(0.007)	(0.010)
loan		0.093***	0.095***	0.017***	0.020***	0.014
		(0.007)	(0.007)	(0.004)	(0.004)	(0.009)
exp		0.011	-0.021**	-0.053***	-0.072***	-0.046***
		(0.009)	(0.009)	(0.006)	(0.006)	(0.010)
_cons	0.777***	0.037	-0.143***	0.640***	0.446***	0.573***
	(0.006)	(0.041)	(0.044)	(0.032)	(0.037)	(0.076)
Control variable	No	Yes	Yes	Yes	Yes	Yes
Fixed time	No	No	No	Yes	Yes	Yes
Fixed region	No	No	Yes	No	Yes	Yes
Observed value	6576	6576	6576	6576	6576	6576
R^2	0.441	0.615	0.619	0.849	0.849	0.931

* p < 0.1, ** p < 0.05, *** p < 0.01 Note: *, ** and *** respectively mean the significance level of 10%, 5% and 1%, and the brackets are the clustering robust standard error at the county level, the same as in the following table.

Table 4: Effect of poverty alleviation on the income of urban residents in state-level impoverished counties

	(1)	(2)	(3)	(4)	(5)	(6)
did	0.504***	0.377***	0.375***	0.040***	0.042***	0.037***
	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)
pop		0.014	0.036***	-0.011	0.013	0.232***
		(0.012)	(0.013)	(0.010)	(0.011)	(0.031)
second		1.012***	1.021***	0.091**	0.103**	0.029
		(0.067)	(0.065)	(0.045)	(0.045)	(0.050)
third		2.070***	2.045***	0.060	0.088*	0.028
		(0.075)	(0.074)	(0.053)	(0.052)	(0.057)
save		0.045**	0.104***	-0.084***	-0.055***	-0.051***
		(0.018)	(0.018)	(0.011)	(0.012)	(0.014)
loan		0.194***	0.182***	0.057***	0.055***	0.062***
		(0.013)	(0.013)	(0.008)	(0.008)	(0.010)
exp		0.144***	0.125***	-0.012	-0.024**	-0.031**
		(0.018)	(0.017)	(0.011)	(0.011)	(0.012)
_cons	2.211***	0.698***	0.795***	1.883***	1.901***	1.351***
	(0.010)	(0.076)	(0.080)	(0.057)	(0.064)	(0.134)
Control variable	No	Yes	Yes	Yes	Yes	Yes
Fixed time	No	No	No	Yes	Yes	Yes
Fixed region	No	No	Yes	No	Yes	Yes
Observed value	6576	6576	6576	6576	6576	6576
R^2	0.407	0.592	0.595	0.866	0.867	0.930

The research results show that the timely lifting of the impoverished counties has a significant promoting effect on the income of urban and rural residents. The main reasons for the promotion are: (1) Adjusting measures to local conditions, time, and circumstances. After years of unremitting poverty alleviation and development, many impoverished counties have been deceived, and some impoverished counties have a higher level of development, such as Wuqi County in Shaanxi Province and Changfeng County in Anhui Province. On the one hand, the timely lifting of the impoverished counties reduces the degree of dependence on fiscal transfer payments and preferential policies and stimulates the endogenous development momentum of impoverished counties. On the other hand, it can make poverty alleviation resources play a greater role and improve resource utilization efficiency. (2) Adopting the principle of positive incentive to improve the security mechanism. The state has launched the Opinions on Establishing a Poverty Exit Mechanism to provide a sound guarantee for the consolidation of poverty alleviation achievements and rural revitalization in state-level impoverished counties. Timely lifting of the impoverished counties not only stimulates the income of farmers in state-level impoverished counties but also increases the income of urban residents to achieve common prosperity.

Parallel Trend Test

This paper uses the Staggered DID method to study the impact of the state-level impoverished counties' "poverty alleviation" on the income of urban and rural residents. The premise is that the parallel trend hypothesis must be met before the policy is processed to ensure the accuracy and objectivity of the research results. This paper refers to the research of Beck et al. (2010) and Li, P. et al. (2016), and uses the event study method to explore the dynamic effect of the income growth of rural residents and urban residents in the counties that have been lifted out of poverty. The specific calculation model is shown in Formula (3) and Formula (4). In which, represents the year before the county is lifted out of poverty in year. represents the year before the county is lifted out of poverty in year, represents the year the county is lifted out of poverty in year, and the other variables are the same as Formula (3).

$$moneycpiw_{ct} = \alpha + \beta_1 did_{ct}^{-4} + \beta_2 did_{ct}^{-3} \ldots + \beta_8 did_{ct}^{+3} + \beta_9 control_{ct} + \gamma_c + \delta_t + \varepsilon_{ct} \quad (3)$$

$$citymcpiw_{ct} = \alpha + \beta_1 did_{ct}^{-4} + \beta_2 did_{ct}^{-3} \ldots + \beta_8 did_{ct}^{+3} + \beta_9 control_{ct} + \gamma_c + \delta_t + \varepsilon_{ct} \quad (4)$$

As shown in Figure 3 and Figure 4, the horizontal axis represents the estimated time point, and the vertical axis represents the dynamic effect of the income growth of urban and rural residents in the counties that have been lifted out of poverty. The poverty alleviation starts from 2017 to 2020, and all individuals gradually enter the experimental group. This means that by 2020, all individuals have been treated, excluding the control group. When the policy time point is 0, it represents the earliest policy implementation point in 2017. When drawing the graph, 2013 is used as the base period. Figure 3 and Figure 4 show that there is no significant difference in the estimated coefficients of farmers' income and urban residents' income in the state-level impoverished counties before poverty alleviation, while after poverty alleviation, the incomes of farmers and urban residents are different from 0 at the significance level of 1%, and show an increasing trend year by year, with the fastest growth in the third year. Figure 3 and Figure 4 both confirm the correctness of the benchmark regression results.

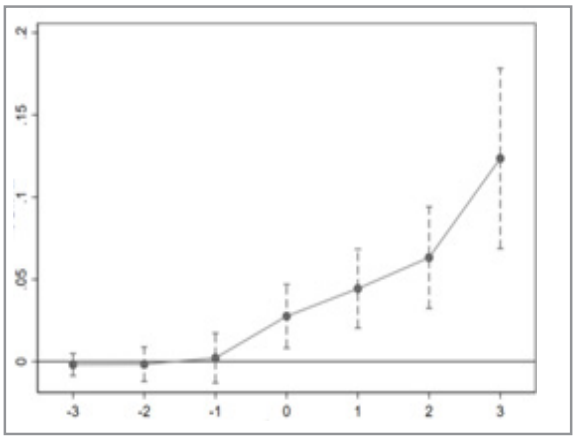

Figure 3: Parallel trend test of rural residents' income

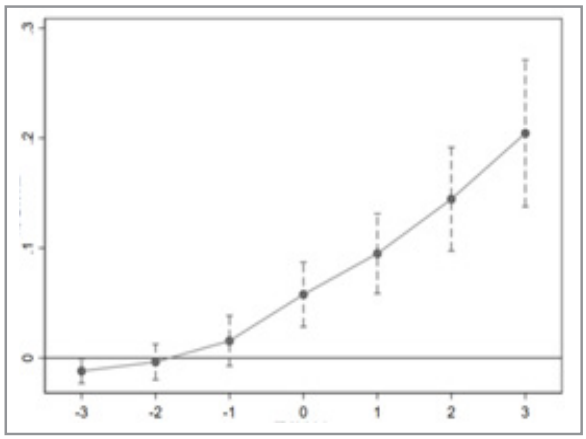

Figure 4: Parallel trend test of urban residents' income

Placebo Test

Placebo test is often used to test the robustness of research results [30]. The basic idea of placebo test in this paper is to randomly generate the experimental period, so as to generate the pseudo-treatment effect, and explore whether it can generate similar income growth effect. First, the treatment effect variables of 822 counties are randomly generated, and then the progressive difference method is used for estimation. Then the above random assignment process is iterated for 1000 times, and the probability distribution of the estimated coefficients of rural residents' income and urban residents' income in the counties is obtained, as shown in Figure 5 and Figure 6.

The horizontal axis in Figure 5 represents the estimated value obtained by randomly assigning the experimental period, and the vertical axis represents the frequency value of the effect generated by random iteration for 1000 times. The virtual vertical line in the figure is the estimated value of the impact of poverty alleviation on farmers' income, which is 0.029. Figure 5 shows that the estimated results are between-0. 01 and 0.01, and concentrated around 0, which means that the income growth effect of impoverished counties is not significant when they are randomly given the experimental period of poverty alleviation, and there is no intersection between the probability distribution map and the benchmark regression estimation value of 0.029 of the impact of poverty alleviation on farmers' income in state-level impoverished counties, indicating that the income growth effect of rural residents after poverty alleviation is brought by poverty alleviation, but not by other factors.

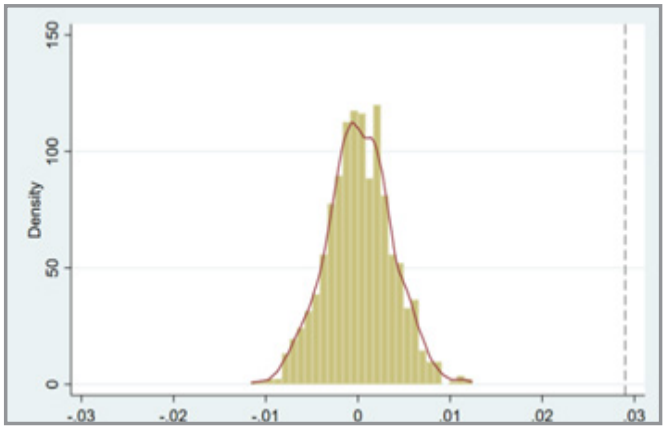

Figure 5: Probability distribution diagram of farmers' income estimation coefficient in impoverished county

The estimated results in Figure 6 are between-0. 19 and 0.19, which are also concentrated around 0. The virtual vertical line in the figure is the estimated value of the impact of "getting rid of poverty and poverty alleviation" on the income of urban residents in state-level impoverished counties, which is 0.042. The probability distribution diagram does not intersect with the benchmark regression estimate of the impact of the state-level impoverished counties on the income of urban residents, indicating that the experimental period of the state-level impoverished counties is randomly assigned, and does not make the income of urban residents in the state-level impoverished counties have a significant growth effect, indicating that the growth effect of the state-level impoverished counties on the income of urban residents is brought by the state-level impoverished counties, and is not caused by other factors.

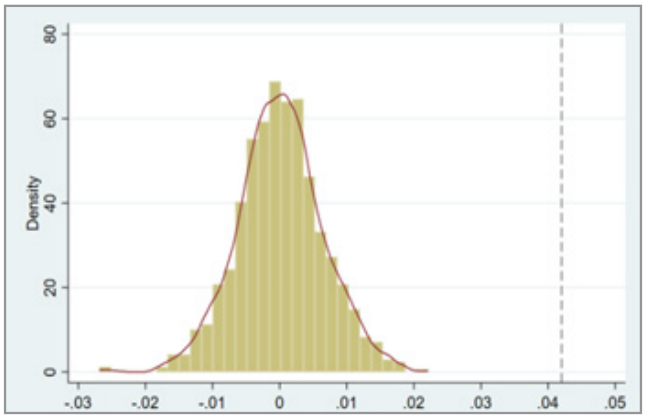

Figure 6: Probability distribution diagram of income estimation coefficient of urban residents in impoverished county

Robustness Test

Robustness test can ensure the accuracy and reliability of the research results. Therefore, referring to the research of Zhang Guojian, this paper lags the explanatory variables and control variables by one period and re-estimates them [17]. As shown in Table 5, the coefficient sign and significance level of the robustness test results are basically consistent with the benchmark regression results, indicating that the results of this study are robustness. In order to prevent the interference of specific regions to the estimation results, this paper re-analyzes the data by changing the sample range after deleting municipalities and autonomous regions directly under the Central Government. The research results are shown in columns (2) and (4) of Table 5, and the estimated results are still positively significant, which is basically consistent with the benchmark regression results, thus ensuring the robustness of the conclusion. Then, the robustness test is carried out by replacing the core explanatory variable, and the core explanatory variable did is replaced by loan for robustness test. As shown in columns (1) and (2) of Table 6, the estimation results and the benchmark regression results are both positively significant, which also ensures the robustness of the research conclusion.

Table 5: Robustness test results (1)

Variable	(1)	(2)	(3)	(4)
	First period of farmers' income lags	Farmers' income excludes municipalities and autonomous regions	First period of urban residents' income lags	The income of urban residents excludes municipalities and autonomous regions
L.did	0.025***	0.024***	0.044***	0.039***
	(0.004)	(0.004)	(0.007)	(0.009)
L.pop4	0.031***	0.037***	-0.009	0.021
	(0.007)	(0.006)	(0.011)	(0.013)
L.second4	-0.099***	-0.008	0.015	0.095*
	(0.027)	(0.026)	(0.048)	(0.054)
L.third4	-0.049	0.108***	0.033	0.101
	(0.032)	(0.030)	(0.057)	(0.063)
L.save4	-0.005	-0.024***	-0.051***	-0.087***
	(0.007)	(0.006)	(0.013)	(0.014)
L.loan4	0.020***	0.041***	0.049***	0.093***
	(0.005)	(0.005)	(0.008)	(0.010)
L.exp4	-0.072***	-0.061***	-0.024**	-0.044***
	(0.006)	(0.007)	(0.011)	(0.015)
_cons	0.611***	0.404***	2.189***	1.880***
	(0.039)	(0.036)	(0.068)	(0.076)
Fixed time	Yes	Yes	Yes	Yes
Fixed region	Yes	Yes	Yes	Yes
Observation value	5754	5056	5754	5056
R^2	0.836	0.888	0.842	0.862

Table 6: Robustness test results (2)

Variable	(1)	(2)
	Income of Farmers	Income of urban residents
loan	0.020***	0.055***
	(0.004)	(0.008)
did	0.028***	0.042***
	(0.004)	(0.007)
second	-0.035	0.104**
	(0.026)	(0.045)
third	0.065**	0.086
	(0.030)	(0.052)
save	0.004	-0.054***
	(0.007)	(0.011)
exp	-0.078***	-0.026**
	(0.006)	(0.011)
_cons	0.598***	1.958***
	(0.024)	(0.042)
Fixed time	Yes	Yes
Fixed region	Yes	Yes
Observation value	6576	6576
R^2	0.849	0.867

Analysis of Regional Heterogeneity

China is a vast country with uneven development among regions. According to the differences of geographical location, natural resources, economic development level and regional development policies, and referring to the research of Yuan Hang, this paper divides the national impoverished counties into eastern region, central region and western region, studies the regional heterogeneity of income growth of urban and rural residents in this county after poverty alleviation, and establishes models as shown in Formula (5) and Formula (6) [31]:

$$moneycpiw_{ct} = \alpha + \beta_1 did_{ct} \times area_c + \beta_2 control_{ct} + \gamma_c + \delta_t + \varepsilon_{ct} \quad (5)$$

$$citymcpiw_{ct} = \alpha + \beta_3 did_{ct} \times area_c + \beta_4 control_{ct} + \gamma_c + \delta_t + \varepsilon_{ct} \quad (6)$$

Among them, area is a set of binary variables, which is used to reflect the heterogeneity between regions. e=1 means that impoverished counties belong to the eastern region, whereas e=0; Similarly, w=1 represents the western region, whereas w=0; m=1 represents the central region, whereas m=0; n=1 represents the northern region, whereas n=0; s=1 represents the southern region, otherwise s=0; eth=1 means that impoverished counties belong to eight ethnic provinces , whereas eth=0; noneth=1 represents eight provinces that do not belong to ethnic groups, on the contrary, noneth=0; Other variables are the same as formula (1).

The results of Table 7 show that the poverty alleviation has a significant positive effect on the income of farmers in the state-level impoverished counties in the eastern region, the western region, the eight ethnic minority provinces and the southern region, has an insignificant negative effect on the income of farmers in the state-level impoverished counties in the central region, has an insignificant positive effect on the income of farmers in the state-level impoverished counties in the non-ethnic minority eight provinces, and has a significant negative effect on the income of farmers in the state-level impoverished counties in the northern region. The development levels of the western, central and eastern regions of China are heterogeneous. Even if they are all impoverished counties, because the eastern and southern regions rely on their good geographical advantages, the impoverished counties in this region often have good development endowments and potentials. In addition, a series of policy guarantees and positive incentive mechanisms have stimulated the enthusiasm and creativity of the masses to get rid of poverty and become rich, which makes farmers' income still show an increasing trend after impoverished counties in the eastern and southern regions. However, the economic development level and industrial development level in the central and western regions are low, and the infrastructure and endogenous development power are weak, so that the income of farmers in impoverished counties in the central region has not increased significantly. However, because the western region is slightly inclined by the national policy, the guarantee and incentive measures for impoverished counties have a certain promotion effect on farmers' income in impoverished counties in the western region, but the positive effect is smaller than that in the eastern region. Moreover, as the areas where minority groups gather are the main areas of poverty alleviation, the separate study of ethnic and non-ethnic groups is also of great significance to explore regional heterogeneity. This paper differs slightly from Fan Yanli and Cong Shuhai's research results on the counties in the eight ethnic minority provinces and the eight non-ethnic minority provinces. In this paper, poverty alleviation has a significant positive effect on the income of farmers in the state-level impoverished counties in the eight ethnic minority provinces, but has no significant positive effect on the income of farmers in the non-ethnic minority counties. Because this paper expands the research sample to all counties, the impoverished areas in 2020 are the most difficult remote counties, so the overall effect on the improvement of the income level of farmers in the state-level impoverished counties in the eight ethnic minority provinces is significant.

Table 7: Regional heterogeneity of farmers' income growth after poverty alleviation

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Eastern region	Central region	Western region	Eight non-ethnic provinces	Eight ethnic provinces	Northern region	Southern region
did×e	0.054***						
	(0.009)						
did×m		-0.007					
		(0.005)					
did×w			0.018***				
			(0.004)				
did×noneth				0.004			
				(0.004)			
did×eth					0.021***		
					(0.004)		
did×n						-0.014***	
						(0.004)	
did×s							0.031***
							(0.004)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed time	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed region	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation value	384	1696	4496	3624	2952	3512	3064
R^2	0.850	0.849	0.849	0.849	0.849	0.849	0.850

The results of Table 8 show that poverty alleviation also has a significant positive effect on the income of urban residents in the state-level impoverished counties in the eastern region, the western region, the eight ethnic minority provinces and the southern region. It has a significant negative effect on the income of urban residents in the state-level impoverished counties in the central region and the northern region, and has an insignificant negative effect on the income of urban residents in the state-level impoverished counties in the non-ethnic minority eight provinces. Because the counties in the eastern and southern regions have better natural endowments and location conditions, and the western regions have more policy preferences, the urban residents' incomes in the counties are improved under the security measures and incentive measures. Regardless of the income of farmers or urban residents, the empirical results show a differentiation pattern of "high at the eastern and western ends, slightly lower in the middle, higher in the south, and slightly lower in the north." The central region and the eight non-national provinces are mostly the same regions in geographical location. This phenomenon, which is slightly lower in the central and northern regions, indicates that the policies of consolidating poverty alleviation achievements and rural revitalization should be tilted towards poverty alleviation counties in the central and northern regions.

Table 8: Regional heterogeneity of urban residents' income growth after poverty alleviation

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Eastern region	Central region	Western region	Eight non-ethnic provinces	Eight ethnic provinces	Northern region	Southern region
did×e	0.186***						
	(0.016)						
did×m		-0.055***					
		(0.008)					
did×w			0.035***				
			(0.007)				
did×noneth				-0.010			
				(0.007)			
did×eth					0.049***		
					(0.007)		
did×n						-0.040***	
						(0.007)	

did×s							0.086***
							(0.007)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed time	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed region	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation value	384	1696	4496	3624	2952	3512	3064
R^2	0.869	0.867	0.867	0.866	0.867	0.867	0.869

Further Analysis

Data and Variable Settings

Based on the theoretical analysis framework and research hypothesis in Section 2, this paper analyzes the impact effect of poverty alleviation in national impoverished counties on urban and rural residents' income in Section 3 and Section 4, and obtains the research results of the overall impact effect, which has preliminarily confirmed the effectiveness of poverty withdrawal mechanism. In order to further analyze the situation of poverty withdrawal mechanism in the following years, this paper will apply the generalized synthetic control method to study the impact of poverty alleviation on urban and rural residents' income in national impoverished counties. It can not only explore the average treatment effect to verify the rationality of the research results of asymptotic double difference method, but also explore the interannual impact effect, which will make certain contributions to consolidating poverty alleviation achievements and regional development in the future.

Because the generalized synthetic control method requires a long pretreatment period to ensure the unbiasedness of the results, this chapter selects 2010-2020 as the observation period. Generalized synthetic control method synthesizes the objects that have not implemented the policy as the control group, so relaxing the observation time has no impact on the research results. Based on the principle of data accessibility, 822 counties in impoverished counties are taken as the experimental group, and non-poverty counties in Gansu, Jiangxi, Guizhou, Guangxi Zhuang Autonomous Region, Henan, Hebei, Hainan and Heilongjiang provinces are taken as the control group. The descriptive statistics of the counties in the experimental group are shown in Table 2, and the descriptive statistics of the non-poverty counties in the control group are shown in Table 9.

Table 9: Descriptive statistics of non-poverty counties in the control group

Variable	Observation value	Average value	Standard deviation	Minimum value	Maximum value
moneycpiw	4620	1.009	0.326	0.241	2.637
citymcpiw	4620	2.145	0.524	0.608	4.273
did	4620	0.000	0.000	0.000	0.000
pop	4620	4.724	0.676	0.895	6.307
second	4620	0.445	0.169	0.043	0.901
third	4620	0.382	0.139	0.083	1.183
save	4620	0.801	0.491	0.047	5.649
loan	4620	0.612	0.468	0.031	3.946
exp	4620	0.177	0.112	0.013	1.116

Evaluation model of Inter-Annual Impact Effect

Generalized synthetic control method is suitable for evaluating the impact effect of multiple policy points and multiple policy locations. Compared with traditional measurement methods, this method relaxes the assumption of parallel trend, and is more efficient than synthetic control method. The counterfactual framework constructed by this method is: the synthetic control group is constructed by linear fitting in the areas that have not implemented the policy, and the synthetic control group is compared with the experimental group to obtain the policy effect [32]. Therefore, the generalized synthetic control method is used for further research.

Assuming that the observation variables of N once-impoverished counties from 2010 to 2020 are , .,the unit sets of the treatment group and the control group are expressed as and , indicating that the counties are lifted out of poverty during the period, and the counties that are not poor counties are taken as samples of the control group, so as to establish a model, as follows:

$$y_{it} = \delta_{it} \bullet D_{it} + x'_{it}\beta + \lambda'_i f_t + \varepsilon_{it} \quad (7)$$

The model of formula (7) is expressed as a dummy variable of poverty alleviation . If the county is poverty alleviation in the current period , the value is 1, otherwise it is 0; Deal with the effect of policy. As the control variable , change equation (7) to the vector form :

$$Y_i = \delta_i \circ D_i + X_i\beta + F\lambda + \varepsilon_i \quad (8)$$

The data generation process of the control group obtained from equation (8) is: , and its vector form is:

$$Y_b = X_b\beta + F\Lambda_b^{'} + \varepsilon_b \quad (9)$$

Among them, in formula (8), its corresponding result is and , so the policy effect of the once-impoverished county brought about

by the policy of poverty alleviation is:

$$Y_{it}(1)-Y_{it}(0)=(\delta_{it}+X_{it}^{'}\beta+\lambda_i^{'}f_t+\varepsilon_{it})-(X_{it}^{'}\beta+\lambda_i^{'}f_t+\varepsilon_{it})=\delta_{it} \quad (10)$$

In formula (10), the observed result variables can be directly obtained, but the observed values of the control group cannot be directly obtained. Therefore, Xu proposes to obtain MSPE by cross-validation according to the leave-one method, and determine the optimal number of factors according to the minimization of MSPE. Then, the control group was estimated by applying an interactive fixed effect model, and the model was as follows:

$$(\hat{\beta},\hat{F},\hat{\Lambda}_b)=\arg\min\sum_{i\in b}(Y_i-X_i\tilde{\beta}-\tilde{F}\tilde{\lambda}_i)^{'}(Y_i-X_i\tilde{\beta}-\tilde{F}\tilde{\lambda}_i)$$
$$s.t.\tilde{F}^{'}\tilde{F}/T=I_r \text{ and } \tilde{\Lambda}_b^{'}\tilde{\Lambda}_b=diagonal \quad (11)$$

Then, the factor load of each treatment group was estimated, with the superscript 0 representing the period before the poverty alleviation:

$$\hat{\lambda}_i=\arg\min\sum_{i\in b}(Y_i^0-X_i^0\hat{\beta}-\hat{F}^0\tilde{\lambda}_i)^{'}(Y_i^0-X_i^0\hat{\beta}-\hat{F}^0\tilde{\lambda}_i)=(\hat{F}^{0'}\hat{F}^0)^{-1}\hat{F}^{0'}(Y_i^0-X_i^0\hat{\beta}) \quad (12)$$

According to , and from Formula (11) and Formula (12), the results of the control group are:

$$\hat{Y}_{it}(0)=X_{it}^{'}\hat{\beta}+\hat{\lambda}_i^{'}\hat{f}_t \quad (13)$$

in formula (13) is the unbiased estimator, so the policy effect of the once-impoverished county in the period brought about by the poverty alleviation policy of formula (10) can be obtained. Therefore, the average treatment effect of the poverty alleviation is:

$$ATT_t=\frac{1}{N_a}\sum_{i\in a}(Y_{it}(1)-Y_{it}(0))=\frac{1}{N_a}\sum_{i\in a}\delta_{it} \quad (14)$$

Analysis of Inter-Annual Impact Effect Results

First of all, this paper studies the inter-annual impact of the policy of "poverty alleviation" on the income of rural residents in the state-level impoverished counties, as shown in Figure 7 and Figure 8. Before the implementation of poverty alleviation, the real value of rural residents' income in state-level impoverished counties is very close to the combined value, which shows that the combined control group has a good fitting degree, and the optimal number of factors is 2 (MSPE=0. 00167) according to the principle of MSPE minimization. After the implementation of poverty alleviation policy, the real value of rural residents' income is always above the synthetic value, and the difference between them is above the 0 axis. After the implementation of the policy, the income of rural residents in state-level impoverished counties has increased significantly in three years, but in the fourth year, the policy effect of poverty alleviation to promote rural residents' income has declined. Although the income increase effect is positive in 2020, its weakened policy effect is not significant, which also means that the policy effect is not obvious in the fourth year. Through the calculation of Rstudio software, it can be seen that the average value of comprehensive policy treatment effect on the income of rural residents in state-level impoverished counties is 0.0319, which is close to the bidirectional fixed effect coefficient of Staggered DID method of 0.029, which proves once again that the implementation of impoverished policies has indeed brought significant promotion to the income of rural residents in state-level impoverished counties as a whole.

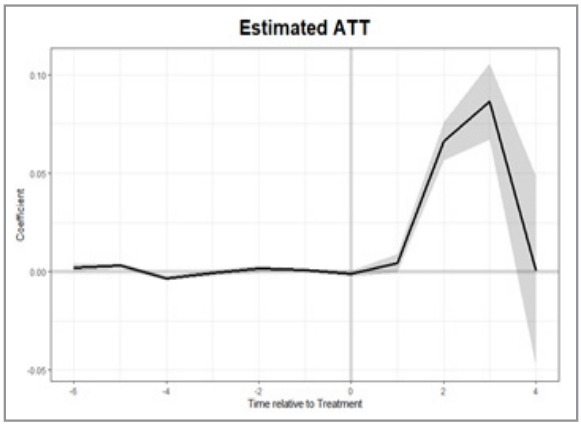

Figure 7: Change of treatment effect of poverty alleviation on rural residents' income in state-level impoverished counties

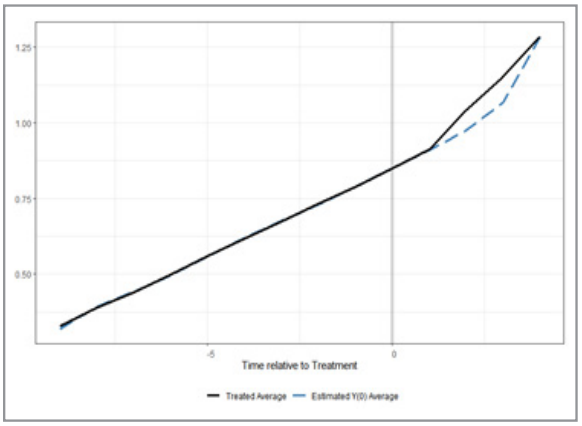

Figure 8: Comparison of actual treatment effect and estimated treatment effect of poverty alleviation on rural residents' income in state-level impoverished counties

The time point set by the generalized synthetic control method using Rstudio software is slightly different from that set by the progressive difference method using Stata software. The generalized synthetic control method sets 2017 as the first year of the policy, which is represented as the 1 point on the abscissa in the figure, while the progressive difference method sets 2017 as the 0 point on the abscissa. Although the two have a slight difference in the time point labeling, the difference in the policy effect in subsequent years is not significant, and the results of the two are slightly different in 2020. Figure 7 and Figure 9 respectively show the changes in the treatment effect of the "poverty alleviation" of the state-level impoverished counties on the income of rural residents and urban residents. The results of the generalized synthetic control method in 2020 are slightly different from those of the progressive difference method, but the weakening policy effect is not significant.

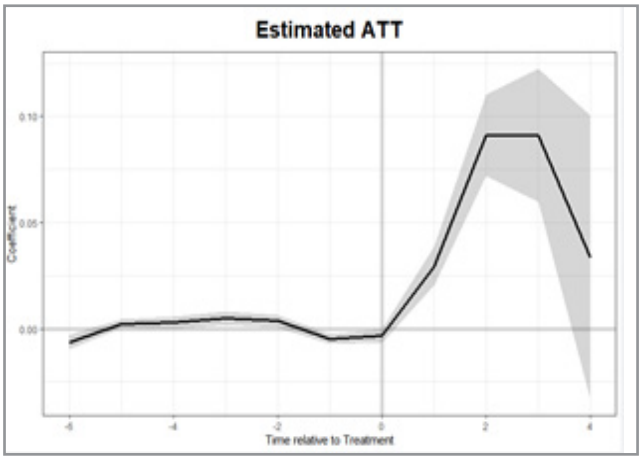

Figure 9: The change of the treatment effect of the poverty relief policy on the income of urban residents in state-level impoverished counties

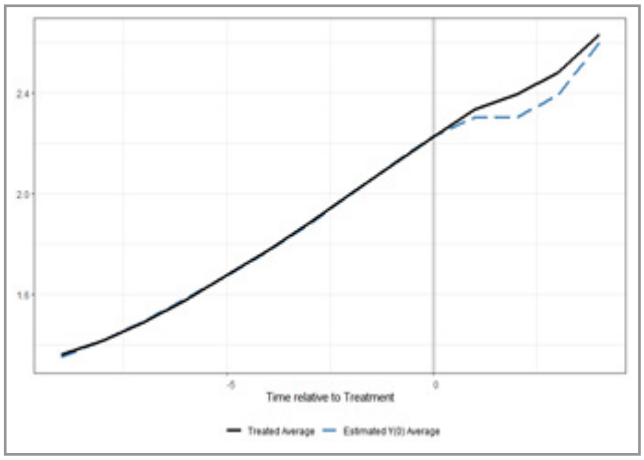

Figure 10: The comparison of the actual and estimated treatment effects of the poverty relief policy on the income of urban residents in the state-level impoverished counties

The generalized synthetic control method can accurately calculate the interannual impact effect of the policy. As shown in Table 10, in the year of poverty alleviation, the impact effect of the policy on the income of rural residents in the state-level impoverished counties is 0.00434, the impact effect in the second year is 0.06620, the impact effect in the third year is 0.08633, and the impact effect in the fourth year is 0.0003. The significance level of the estimated results of the impact effect in the first year is 10%, and the significance level of the estimated results of the impact effect in the second and third years is 1%. Although the effect of the policy implementation in the fourth year weakens, its impact effect is not significant.

Table 10: The inter-annual impact of poverty alleviation on the income of rural residents in state-level impoverished counties

Relative treatment period	Average treatment effect	Period treatment effect	Standard deviation	Lower limit of 95% confidence interval	Upper limit of 95% confidence interval	Value p	n.Treated
-6	0.032	0.002	0.001	8.66E-05	0.004	0.040	0.000
-5		0.003	0.001	0.002	0.004	4.34E-06	0.000
-4		-0.003	0.001	-0.005	-0.002	1.34E-06	0.000
-3		-0.001	0.001	-0.002	0.001	0.388	0.000
-2		0.002	0.001	-1E-04	0.003	0.067	0.000
-1		0.001	0.001	-3E-04	0.002	0.178	0.000
0		-0.001	0.001	-0.003	3E-04	0.123	0.000
1		0.004	0.002	-3E-04	0.009	0.066	822.000
2		0.066	0.005	0.057	0.076	0.000	449.000
3		0.086	0.010	0.067	0.106	0.000	151.000
4		3E-04	0.025	-0.048	0.049	0.990	28.000

Furthermore, this paper studies the inter-annual impact of the poverty relief policy in the state-level impoverished counties on the income of urban residents, as shown in Figure 9 and Figure 10. Before the implementation of the poverty relief policy, the fitting degree of the real value and the composite value of the income of urban residents in the county is very good. According to the principle of minimizing MSPE, the optimal number of factors is 2 (MSPE = 0.00503). After the implementation of the poverty relief policy, the Estimated ATT is above the 0 axis. The average value of the comprehensive policy treatment effect is positive, and the specific value is 0.054, which is close to the bidirectional fixed effect coefficient of the Staggered DID method (0.042), confirming that the implementation of the poverty relief policy has an increasing effect on the income of urban residents in the state-level impoverished counties. The poverty relief policy in the state-level impoverished counties has a significant impact on the income of urban residents in the first three years, but not significant in the fourth year.

As shown in Table 11, in the year of poverty alleviation, the impact of policies on the income of urban residents in impoverished counties is 0.02930, 0.09113 in the second year, 0.09099 in the third year and 0.03367 in the fourth year. The impact of poverty alleviation policy on the income of urban residents in impoverished counties has increased significantly in the first three years, and the significance level of the estimated results of the impact effect is 1%. Although the policy effect in the last year is positive, it is no longer significant.

Table 11: Inter-annual effect of poverty alleviation and hat removal on the income of urban residents in state-level impoverished counties

Relative treatment period	Average treatment effect	Period treatment effect	Standard deviation	Lower limit of 95% confidence interval	Upper limit of 95% confidence interval	Value p	n.Treated
-6	0.054	-0.006	0.002	-0.010	-0.003	2E-04	0.000
-5		0.002	0.001	1E-04	0.005	0.040	0.000
-4		0.003	0.002	-2E-04	0.006	0.071	0.000
-3		0.005	0.002	0.002	0.008	0.001	0.000
-2		0.006	0.002	0.001	0.007	0.020	0.000
-1		-0.005	0.001	-0.007	-0.003	2.91E-05	0.000
0		-0.003	0.002	-0.007	-7.31E-05	0.045	0.000
1		0.029	0.005	0.020	0.039	6.70E-10	822.000
2		0.091	0.010	0.072	0.110	0.000	449.000
3		0.091	0.016	0.060	0.122	1.34E-08	151.000
4		0.034	0.034	-0.033	0.101	0.323	28.000

Research on the Mechanism of Action

Setting of the Mechanism of Action Model

In 2020, the national impoverished counties were fully rid of poverty. In order to consolidate the achievements of poverty alleviation and promote the continued development of impoverished areas, the state issued the Opinions on Realizing the Effective Connection between Consolidating and Expanding the Achievements of Poverty Alleviation and Rural Revitalization. The "Opinions" put forward that a five-year transition period needs to be set up after the national impoverished counties have been lifted out of poverty. The county should adapt to local conditions and times, do a good job in the development plan of impoverished areas, strive to achieve the goals of effective governance, prosperous industry and affluent life, continue to implement security policies such as education and medical care, continue to improve industrial development, and ensure that the masses get rich through employment with conditional assistance from the government. By 2025, the education level, medical and health level of impoverished areas will be greatly improved, and the economic vitality and development momentum will also be significantly enhanced.

Regarding the industrial development in impoverished areas, it mainly includes the follow-up development of planting and breeding industry. For the planting and breeding industry, we must first develop “one county, one industry” and adhere to the coordinated development of urban and rural areas in the county. Secondly, build standardized production bases, improve the level of agricultural mechanization and agricultural production technology to obtain high-quality agricultural products. For industry, the funds for consolidating poverty alleviation achievements and connecting rural revitalization will be used to focus on supporting advantageous industries in impoverished areas. The investment will be increased year by year to promote industrial quality and efficiency, create more employment opportunities, and promote endogenous sustainable development. Regarding the medical development in impoverished areas, the funds for health projects will remain stable during the transition period, and will be tilted to the counties that have left out of poverty and key counties for rural revitalization. It’s also important to strengthen the training of medical and health talents in once-impoverished counties, so as to reduce or eliminate major diseases, so as to improve the health level of urban and rural residents in once-impoverished counties and prevent the residents in once-impoverished counties from returning to poverty due to illness. With regard to the development of education in impoverished areas, by consolidating the achievements of school dropout control and the construction of teachers, we can promote the all-round development of students and education in impoverished areas, strengthen intellectual support and inspirational education, and block the intergenerational transmission of poverty through self-struggle, so as to increase the income of urban and rural residents in Jiemao County. With regard to the development of social welfare level in impoverished areas, increase the number of adoptive units of social welfare institutions in impoverished areas, further improve the social welfare network, provide certain living guarantee for special groups such as the disabled, the destitute elderly and orphans, and prevent residents from returning to poverty due to excessive economic expenditure of special groups, thus increasing the income of urban and rural residents with special groups in the county. Finally, the county-level finance provides conditional and restricted assistance to groups in impoverished areas, stimulates their psychology of getting rich, and improves the local financial hematopoietic capacity of once-impoverished counties, thus increasing the income of urban and rural residents in once-impoverished counties. The mechanism of the impact of poverty alleviation on the income of urban and rural residents in national impoverished counties is shown in Figure 11:

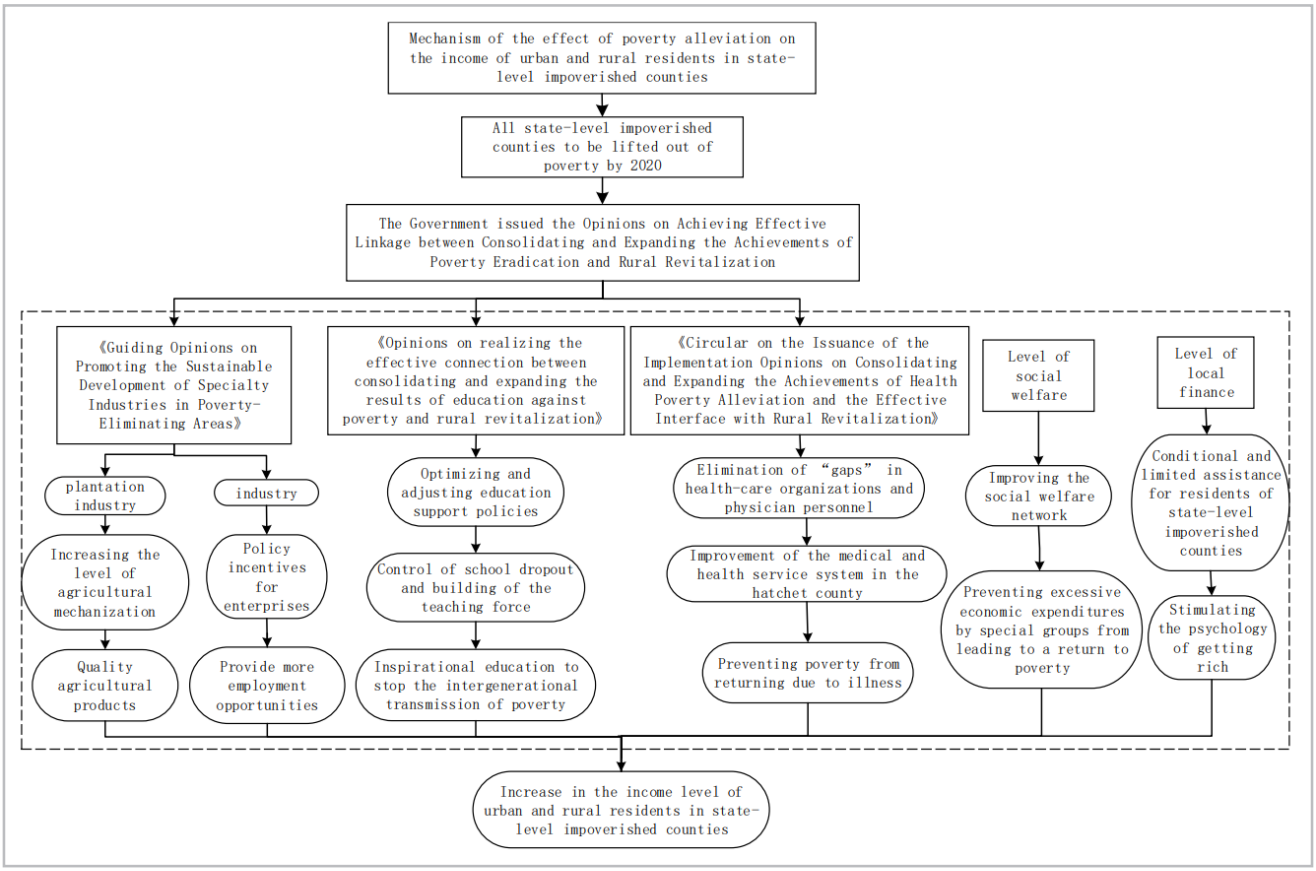

Figure 11: Mechanism diagram of the impact of poverty alleviation on the income of urban and rural residents in nationally impoverished counties

Through literature and policy research, it is found that the exit mechanism of nationally impoverished counties mainly uses the level of agricultural mechanization, industrial development, education, medical care, social welfare, and local financial hematopoietic capacity to promote the impoverished urban and rural residents in national impoverished counties to get rid of poverty and increase their income. Based on the path of the mechanism of action and the research of Fan Yanli (2021), this paper uses the total power of agricultural machinery (none) to represent the level of agricultural mechanization, uses the logarithmic value of the total output value of industrial enterprises above the large-scale (scale) to represent the scale of industrial development4, and uses the gross output value of the tertiary industry/gross output value of the secondary industry (third_second) to represent the structure of industrial development. The number of full-time teachers in ordinary primary schools/the number of students in ordinary primary schools and the number of full-time teachers in ordinary middle schools/the number of students in ordinary middle schools are taken as the second-level indicators to measure the level of basic education, and the entropy method is used to construct the index (edu) to measure the level of education. The number of beds in medical institutions and the number of medical technicians in county-level medical institutions are taken as the second-level indicators to measure the level of basic medical care, and the entropy method is used to construct the county-level medical care index (medi). In addition, the number of beds in various social welfare adoption units represents the service level (welbed) of county social welfare institutions; and the financial self-sufficiency rate represents local financial capacity (cai).

In the study of action mechanism, this paper refers to the research of Li Peixin and Zhang Xueliang and the research of Xu Jia and Cui Jingbo to construct the interaction term between intermediary variables and core explanatory variables to study the action mechanism [11, 33]. In the analysis of the mechanism of the impact of poverty alleviation on the income of urban and rural residents in impoverished counties, there are mainly six action paths. Therefore, this paper studies the mechanism of action according to the indicators in the six action paths, among which represents the various variables of the mechanism of action, and represent the level of agricultural mechanization, industrial development, education, medical care, social welfare and local financial hematopoietic capacity, and other variables are the same as formulas (1) and (2).

$$moneycpiw_{ct} = \alpha + \beta_1 did_{ct} \times jizhi + \beta_2 jizhi_{ct} + \beta_3 did_{ct} + \beta_4 control_{ct} + \gamma_c + \delta_t + \varepsilon_{ct} \quad (15)$$

$$citymcpiw_{ct} = \alpha + \beta_5 did_{ct} \times jizhi + \beta_6 jizhi_{ct} + \beta_7 did_{ct} + \beta_8 control_{ct} + \gamma_c + \delta_t + \varepsilon_{ct} \quad (16)$$

Analysis of Action Mechanism and Results

Table 12 shows that the improvement of agricultural mechanization level can significantly promote the income of farmers in impoverished counties, and can effectively improve agricultural production efficiency, realize the transformation from low cost to high efficiency, and lay a solid foundation for the realization of the poverty alleviation goal. The improvement of industrial scale in impoverished counties has no significant effect on the income of farmers. This is mainly because the number of industrial enterprises above designated size in impoverished counties

is very small, so it has no significant effect on the endogenous development power of impoverished counties. The ratio of tertiary industry to secondary industry represents the level of advanced industrial structure in the region. The results show that the positive effect on the income of farmers in impoverished counties is not significant. It shows that the advanced industrial structure in impoverished counties is not completely mature at the present stage, and has not achieved the effect of significant income increase. It is necessary to continue to strengthen the enterprise cultivation in impoverished counties. The improvement of education level and social welfare level can significantly promote the income of farmers. At the present stage, improving education level can promote the income of farmers by blocking the intergenerational transmission of poverty, and improving social welfare can improve the living standard of poor people, so as to promote the income of farmers in impoverished counties. It is worth noting that the medical level does not play a positive role in promoting the income of farmers in impoverished counties, but its negative effect is not significant. The improvement of local fiscal capacity in impoverished counties has a significant promoting effect on the income of rural residents, indicating that the impoverished policy can improve the income level of rural residents by improving the fiscal capacity.

Table 12: The mechanism of the impact of poverty alleviation on the income of rural residents in state-level impoverished counties

Variables	Agricultural mechanization level	Industrial scale	Tertiary industry/secondary industry	Education	Medical care	Social welfare	Local fiscal capacity
did×nongye	0.013**						
	(0.007)						
did×scale		0.001					
		(0.001)					
did×thi_sec			0.001				
			(0.001)				
did×edu				0.048***			
				(0.017)			
did×medi					-0.008		
					(0.020)		
did×welbed						0.052***	
						(0.016)	
did×cai							0.077***
							(0.019)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed time	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed region	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observed value	6576	6576	6576	6576	6576	6576	6576
R2	0.849	0.850	0.849	0.850	0.850	0.850	0.850

Table 13 reveals that the industrial scale of impoverished counties has an insignificant positive effect on the income of urban residents. Mainly due to the very few industrial enterprises above the county scale and the immature industrial development, the impact on the income of urban residents in impoverished counties is also insignificant, but the coefficient is 0.1% higher than that of farmers' income. For the interaction term of the upgrading of industrial structure and impoverished counties, the research results show that the negative effect on the income of urban residents in impoverished counties is not significant, indicating that whether in the towns or rural areas of impoverished counties, they still need to continue to strengthen enterprise cultivation and promote the upgrading of industrial structure. The improvement of education level and social welfare level can also significantly promote the income of urban residents in impoverished counties, while the medical level has no significant effect on the income of urban residents in impoverished counties. Because the "three security" problems in many places have been basically solved, it is not easy to stabilize and consolidate. In remote areas, many medical services are low, exposing the shortcomings in the field of primary medical and health management, and it is necessary to continue to consolidate and improve the level of medical services. The improvement of local fiscal hematopoietic capacity has a significant promoting effect on the income of urban residents in impoverished counties, indicating that the impoverished policy can improve the income level of urban residents by improving the fiscal hematopoietic capacity of the county. The estimated coefficients in Table 12 and Table 13 are compared. The results reflect that the local fiscal capacity of urban residents in impoverished counties is greater than that of rural residents in impoverished counties, so the income increase effect of urban residents in impoverished counties is greater than that of rural residents in impoverished counties.

Table 13: The mechanism of poverty alleviation's impact on the income of urban residents in state-level impoverished counties

Variables	Industrial scale	Tertiary industry/ secondary industry	Education	Medical care	Social welfare	Local fiscal capacity
did×scale	0.002					
	(0.001)					
did×thi_sec		-0.003				
		(0.002)				
did×edu			0.124***			
			(0.030)			
did×medi				0.016		
				(0.035)		
did×welbed					0.121***	
					(0.028)	
did×cai						0.204***
						(0.034)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes
Fixed time	Yes	Yes	Yes	Yes	Yes	Yes
Fixed region	Yes	Yes	Yes	Yes	Yes	Yes
Observed value	6576	6576	6576	6576	6576	6576
R2	0.867	0.867	0.867	0.867	0.868	0.868
Observed value	6576	6576	6576	6576	6576	6576
R2	0.849	0.850	0.849	0.850	0.850	0.850

Conclusions and Policy Suggestions

Conclusions

This paper adopts the Staggered DID method to study the impact of "poverty alleviation" on the income of urban and rural residents in state-level impoverished counties, and further analyzes it with the generalized synthetic control method. Finally, this paper studies the mechanism of action, in order to provide some reference for consolidating the poverty alleviation achievements and effectively linking rural revitalization. The study implies that:

1. Conclusions on the Income Growth of Urban and Rural Residents

With the support of sound security and incentive policies, the poverty relief policy has significantly increased the income of farmers and urban residents. The two-way fixed effects model shows that the growth effect of urban residents' income is 0.042, and that of rural residents' income is 0.029. The growth effect of urban residents' income is 1.448 times that of rural residents' income. The conclusion shows that with the support of sound and effective poverty withdrawal mechanism and incentive policies, the income level of urban and rural residents in national impoverished counties has been improved. Because the natural endowment of urban development in impoverished areas is better than that in rural areas, with the support of effective poverty exit mechanism, the growth effect of urban residents' income is higher than that of rural residents' income.

2. Conclusions on Regional Heterogeneity

Three years after the poverty relief, the growth effect of both shows an upward trend, but there is regional heterogeneity in the change of farmers' income and urban residents' income after the poverty relief, which shows a differentiation pattern of "high at the east and west ends, low in the middle; high in the south, low in the north". The main reason for this pattern is that the eastern and southern regions rely on good location advantages, and the once-impoverished counties in this region often have better development conditions. Coupled with a series of policy guarantees and positive incentive mechanisms, the income of urban and rural residents in the impoverished counties in the eastern and southern regions still shows an increasing trend after the once-impoverished counties are uncapped. However, the endogenous development power in the central and western regions is relatively weak, which makes the income of farmers in the central region has not increased significantly. However, because the western region is slightly inclined by the national policy, the guarantee and incentive measures for poverty alleviation in the national impoverished counties have a certain promotion effect on the increase of farmers' income in the western region, but the positive effect is smaller than that in the eastern region. Then, the results of the generalized synthetic control method are used to confirm the effectiveness of the poverty exit mechanism.

3. Conclusion on the Mechanism of Action

The results of the study on the mechanism show that the contribution rates of agricultural mechanization level, education level, social welfare level, and local fiscal hematopoiesis capacity to the improvement of farmers' income in the poverty relief county are 0.013, 0.048, 0.052 and 0.077 respectively, and the contribution rates of education level, social welfare level and local fiscal hematopoiesis capacity to the improvement of urban residents' income in the poverty relief county are 0.124, 0.121 and 0.204 respectively. The research results of the mechanism of action are mainly due to the "Opinions on Achieving the Effective Connection between Consolidating and Expanding Poverty Alleviation Achievements and Rural

Revitalization" issued by China. The "Opinions" put forward that after the national impoverished counties have been lifted out of poverty, they should adapt to local conditions and times, do a good job in the development plan of impoverished areas, strive to achieve the goals of effective governance, prosperous industry and affluent life, continue to implement security policies such as education and medical care, continue to improve industrial development, and ensure that the masses get rich through employment with the conditional assistance of the government. However, because there are not many industrial enterprises above the scale in impoverished counties, the improvement of the industrial scale level has no significant effect on the income increase of urban and rural residents in impoverished countries. The medical level does not play a positive role in promoting the income increase of farmers in impoverished countries, but its negative effect is not significant, and its effect on the income increase of urban residents in impoverished counties is not significant. Therefore, we can continue to improve the sanitary environment in impoverished areas, so as to improve the health level of urban and rural residents in once-impoverished counties and prevent residents from returning to poverty due to illness.

Policy Suggestions

Based on the research conclusions, this paper puts forward corresponding policy suggestions to ensure the sustainable income increase of urban and rural residents in impoverished counties and promote regional development, in order to provide some reference for the subsequent development of impoverished counties:

1. Stimulate the endogenous development momentum of impoverished counties and consolidate the achievements of poverty alleviation with positive incentive and guarantee. In the future, the policies of consolidating the achievements of poverty alleviation and rural revitalization should be more inclined to the impoverished counties in central and northern regions. The principle of positive incentive is beneficial to stimulate the enthusiasm and initiative of self-development and independent innovation of impoverished counties, and give corresponding rewards to counties with continuous increase in resident income and economic development level after poverty alleviation, so as to transform the function of fiscal transfusion into hematopoiesis function. At the same time, it should set up an example of poverty alleviation and form a self-driven wealth atmosphere under the security mechanism, so that they can earn subsidies by labor to improve their living standards.
2. In order to consolidate the poverty alleviation achievements and rural revitalization in impoverished counties, the local government should encourage the development of characteristic industries and independent entrepreneurship for counties with a high level of development; for counties with a weak development foundation, it can provide employment training, improve the education level and social welfare level and other measures to consolidate the poverty alleviation achievements. On the premise of the positive incentive policy of poverty alleviation, the effect of "poverty alleviation" on the income increase of urban and rural residents in state-level poverty counties is heterogeneous, especially in counties with superior development conditions can better improve the income increase effect of urban and rural residents. Therefore, when formulating policies related to the consolidation of poverty alleviation achievements and rural revitalization, the government should fully understand the heterogeneity of the development endowment of impoverished counties and enhance the endogenous development momentum of impoverished counties.
3. Improving the level of agricultural mechanization, education level, social welfare level and local fiscal hematopoiesis capacity has a significant promoting effect on the income growth of farmers in impoverished counties, improving the level of education, social welfare level and local fiscal hematopoiesis capacity has a significant promoting effect on the income growth of urban residents in impoverished counties, which provides a realistic path for promoting the income increase of urban and rural residents in impoverished counties.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Notes

1. Poverty Reduction Research Database: https://www.jianpincn.com/zgjpsjk/
2. The eight ethnic minority provinces include: Inner Mongolia Autonomous Region, Ningxia Hui Autonomous Region, Xinjiang Uygur Autonomous Region, Tibet Autonomous Region, Guangxi Zhuang Autonomous Region, Guizhou Province, Yunnan Province and Qinghai Province.
3. Represents dot multiplication of vectors.
4. Industrial enterprises above designated size refer to industrial legal person enterprises with annual main business income of 20 million RMB or more.

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Author Contributions

All authors contributed to the methodology, data collection, analysis, writing, review, and editing. All authors read and approved the final manuscript.

Competing Interests

The authors declare no competing interests.

Ethical Approval

This article does not contain any studies with human participants or animals performed by any of the authors.

Informed Consent

This article does not contain any studies with human participants or animals performed by any of the authors.

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