Article

Not peer-reviewed version

The Poverty Alleviation Role of the "Insurance+Futures" Pattern-- Evidence from 10 Chinese Provinces

Jinhong Han *

Posted Date: 4 March 2025

doi: 10.20944/preprints202503.0183.v1

Keywords: "Insurance+Futures" pattern; poverty alleviation mechanism; rural areas

 doi:10.20944/preprints202503.0183.v1

Article

The Poverty Alleviation Role of the "Insurance+Futures" Pattern—Evidence from 10 Chinese Provinces

Jinhong Han *

Institute of advanced studies in humanities and social sciences Beijing Normal University, China; hanjinhong1080@126.com

Abstract: This paper sorts out the poverty reduction mechanism of this pattern, and uses actual data from the top 10 provinces in China with the highest underwriting value in the "Insurance+Futures" pattern since 2016 to test it by a panel data model. The results show that the "Insurance+Futures" pattern has a significant effect on reducing poverty. By replacing the proxy variable for the dependent variable and changing the samples for testing, yet the results remained significantly valid, demonstrating the robustness of the conclusion.

Keywords: "Insurance+Futures" pattern; poverty alleviation mechanism; rural areas

1. Introduction

The vast majority of impoverished areas in China are located in rural areas of mountainous or plateau regions (Ruoxiang Jia and Xiaoli Hou, 2011). These areas often lack proper infrastructure, have a single industrial structure, and face challenging geographical environment, which can lead to insufficient risk management and unstable income for farmers. But they have good conditions for industrial development in natural resources, agricultural resources, etc., and utilizing advantageous resources to develop industries can be an effective strategy for local poverty alleviation. The "Insurance+Futures" project implemented by Dalian Commodity Exchange for the first time since 2015 is an innovative pattern that can manage agricultural risks and promote agricultural industrialization. This pattern has performed well in practice and has been recognized by the central government. It has also been included in the No.1 Central Document in China for eight years since its implementation, serving as a "stabilizer" and "booster" for comprehensively promoting rural revitalization and guaranteeing the prosperity of local industries. The pattern has been rapidly adopted and expanded.

Since 2016, a total of 73 futures companies have provided risk management services for 18 commodities, including soybeans, corn, and pigs, through the "Insurance+Futures" pattern. The cumulative underwriting value is RMB 134.604 billion, a total of 27.4965 million tons of spot goods were involved. This pattern has covered 1224 counties in 31 provinces, autonomous regions, and municipalities directly under the central government. It has benefited 5.387 million farming households, 3101 specialized farmers' cooperatives, 1488 family farms, and 2349 agricultural enterprises[1].

Many studies suggest that the "Insurance+Futures" pattern is playing an increasingly important role in managing price risk, guaranteeing farmers' income, and promoting poverty alleviation. However, most of these studies are single case studies and lack big data evidence from the current comprehensive economy. Whether to continue carrying out this pattern in the future depends on the existing application results. Therefore, the potential effectiveness of the "Insurance+Futures" pattern in reducing poverty in rural areas is of significant reference value for the high-quality and

[1]The data is from the official website of China Futures Association.

 doi:10.20944/preprints202503.0183.v1

sustainable development of the rural economy in the future. On the basis of sorting out the poverty reduction mechanism of the “Insurance+Futures” pattern, this paper conducts an empirical analysis based on data from the 10 provinces with the largest pilot scale of this pattern in China, in order to enrich the existing literature.

The structure of this article is as follows: The second part is literature review, and the third part is theoretical analysis and research hypothesis. The fourth part is empirical analysis. The fifth part is the conclusion and insights.

2. Literature Review

Due to the fact that the "Insurance+Futures" pattern is a unique creation in China, there is a lack of direct research on this pattern abroad. But there are many studies related to it. In other countries, the pattern of combining the insurance market with the futures market for agricultural risk management is mainly the agricultural revenue insurance (Sun &Xu,2016; Chen,2023). The main difference between revenue insurance and the Chinese "Insurance+Futures" pattern is that in China the insurance companies hedge their risks through the futures market; But out of China, especially in America, risks are transferred through reinsurance for the insurance companies. The similarity between the two is that in the insurance agreement signed between farmers and insurance companies, the agreed price and settlement price are both based on the prices in the futures market[2]

Agricultural revenue insurance originated in the United States. Numerous studies have shown that agricultural revenue insurance helps stabilize farmers' income, indirectly indicating that agricultural revenue insurance contributes to poverty alleviation. Some scholars, such as Makki & Somwaru (2001), Smith (2003), Dismukes (2006), Xu&Liao(2014), Goodwin& Hungerford(2015). Ramsey et al. (2019), and Frascarelli et al. (2021), have theoretically explained the impact of revenue insurance on stabilizing farmers' income. They all analyzed from different perspectives how crop revenue insurance can simultaneously prevent natural and market risks, providing comprehensive risk protection for farmers and meeting their needs for ensuring production income. Especially, Xu&Liao(2014) used the Ramsey Cass-Koopmans (RCK) to prove that crop revenue insurance has a promoting effect on agricultural output. Chalise (2017) discussed a new patten of revenue insurance - the whole farm revenue insurance, which can stabilize the income level of farmers on the entire farm. Other scholars, such as Hennessy et al. (1997), Bielza et al. (2002), Tiemtore (2021), Ahmed&Serra (2015), and Kim et al. (2021), have compared the revenue insurance with traditional insurance and farm support policies, demonstrating that the revenue insurance is more effective in stabilizing farmers' income. Regarding the reasons, Hennessy et al.(1997), Ahmed&Serra (2015), and Tiemtore (2021) all believe that income insurance reduces agricultural project costs and improves efficiency. Kim et al. (2021) validated this using agricultural data from 2015 to 2018 of South Korea.

The development of China's futures market lags behind, and it was not until 2010 that scholars began discussing the issue of introducing crop revenue insurance in China. For example, Cole& Gibson（2010）discusses the feasibility of crop revenue insurance for Chinese maize, soybean, wheat, cotton and rice markets. It was not until 2015 that China officially developed a pattern that combines insurance and futures. Initially, it was a price Insurance+Futures pattern, which quickly became popular. In 2018, China started piloting the revenue Insurance+Futures pattern, but the scale has been relatively small. From then on, extensive research has been conducted on the Insurance+Futures pattern within China, with a particular focus on its role in poverty alleviation. This research has primarily focused on two key aspects as followed:

Firstly, the studies revolved are about the poverty reduction effectiveness of the “Insurance+Futures” pattern. Some researchers such as Tingting Cao and Yongbo Ge (2018), Jiuyang Liu (2022) have demonstrated through theoretical analysis that this pattern is an innovative approach for financial poverty alleviation. The pattern has played a significant role in transferring market risks

[2] China has also started piloting the agricultural "revenue insurance+futures" pattern since 2018, which still has the aforementioned differences from foreign agricultural revenue insurance.

 doi:10.20944/preprints202503.0183.v1

from impoverished farmers, achieving targeted poverty alleviation and winning the Tough Battle Against Poverty in China. This is due to the fact that the vast majority of its selected targets are poverty-stricken counties. The operating mode is unique.

Many other scholars have adopted the method of case studies. They have demonstrated the income guarantee effect of this pattern and demonstrated its role in poverty reduction through actual case analysis in different regions. Several studies have been conducted on various commodities. For instance, Xinci Zhao (2021) analysed a natural rubber pilot project in Baisha County, Hainan Province, Jiuyang Liu (2022) examined the cotton industry in Xinjiang Uygur Autonomous Region, and Wenxuan Hu (2023) investigated peanuts in Runan County. These authors provided a detailed analysis of the running process of "Insurance+Futures" pattern and the profits earned by all participants upon completion of the operation. Research has shown that this pattern is an innovative financial service complex because it combines agricultural product futures, agricultural insurance, and precision poverty alleviation. Empirical analysis conducted by several scholars has proven the effectiveness of this pattern. For example, Yangyang Li and Jianjun Huai (2023) conducted a study using the quasi-natural experimental method and the data from 124 pilot counties in China. The result has shown that the pilot of the "Insurance+Futures" pattern has a significant effect on increasing the farmers' income, which indicates that this pattern has a poverty reducing effect.

Secondly, the studies revolved are about the limitations of the anti-poverty role of the "Insurance+Futures" pattern. Some literature explained the poverty alleviation limitation of this pattern from the perspective of sustainability in poverty alleviation. Existing literature (Chenguang Guo and Xueping Xiong, 2021; Yuanyuan Xu et al., 2022) has shown that an important reason why the "Insurance+Futures" pattern can attract farmers, especially impoverished households, to participate is that farmers generally do not have to bear the cost of insurance or bear little of it, but can receive compensation. The main sources of the premiums are futures exchanges and government subsidies. Because there is an unstable source of premiums it is difficult to sustain this pattern in the long term. In addition, some researches have shown that "Insurance+Futures" pattern is exposed to hedging risk and basis risk exposure, which also affects its sustainability. Under certain conditions, a specific variety can form a risk management loop. But if the risk hedging in the futures market is not ideal and the price discovery function of the futures market is not well performed for some varieties, the risk exposure will come out. In practice, it is difficult to form a risk management loop for varieties with high basis risk, such as apples and red dates. This pattern is also challenging to sustain (Yuanyuan Xu, et al., 2022).

In summary, there is no direct research on the poverty reduction effect of the "Insurance+Futures" pattern outside of China, but relevant studies have shown that crop revenue insurance, which is the most similar pattern to "Insurance+Futures" , can promote stable and growth in farmers' income. In China, currently the literature on the poverty alleviation effect of this pattern mainly focuses on analyzing the effects of different participants through specific cases. However, there is a lack of evidence support from actual comprehensive economic running data. Therefore, this paper aims to first analyze the poverty reduction mechanism of this pattern from a theoretical perspective, and then test the mechanism with actual economic running data from China to examine the poverty reduction effect of this pattern. The study will provide empirical evidence and some suggestions for future applications of this pattern, particularly in the context of China's agricultural risk management.

3. Theoretical Analysis and Hypothesis

3.1. The Poverty Alleviation Mechanisms of the "Insurance+Futures" Pattern

The "Insurance+Futures" pattern plays a poverty alleviation role in the following aspects:

3.1.1. Priority Principle for Impoverished Areas

 doi:10.20944/preprints202503.0183.v1

The “Insurance+Futures” pattern is a typical mode of financial poverty alleviation. From the beginning the pilot of this pattern has been closely integrated with efforts to solve the Agricultural, Rural and Farmers' Issues, as well as poverty alleviation. When selecting pilot areas, Priority should be given to poor regions. The futures exchanges cultivate pilot varieties based on the characteristic of resource endowments in poor areas. In 2015, after the Central Poverty Alleviation Work Conference was held, the China Securities Regulatory Commission issued guidance on poverty alleviation work, and the China Futures Association also successively issued important documents to implement the strategy of the futures industry to serve poverty alleviation. According to the guidance, various entities in the futures industry, especially futures exchanges and exchange companies, took various methods to tilt towards impoverished areas when implementing the pilot work of the “Insurance+Futures” pattern. For example, if poverty-stricken areas carry out “Insurance+Futures” pilot projects, each futures exchange will reduce the commission of futures companies, in order to encourage futures companies to participate; The Futures Industry Association added bonus points for poverty alleviation when evaluating futures companies; Futures exchanges and futures companies took their own funds to subsidize insurance premiums in impoverished areas, ensuring the basic income of impoverished farmers. After selecting pilot poverty-stricken areas, the specific organization and implementation also reflect the poverty priority mechanism. For example, after the specialized working group conducted on-the spot investigation to accurately identify impoverished households, the insurance company prioritized signing contracts with registered impoverished households, achieving an effective combination of this pattern and targeted poverty alleviation.

The priority mechanism for poverty-stricken areas has got remarkable achievements in poverty alleviation and covered wide area. According to data published on the website of the China Futures Association, as of July 5, 2023, the number of counties covered by the “Insurance+Futures” business in China has increased to 832, and the number of farmers benefited has increased to 1,785,600 households. Among them, the business covers 245 former national-level poverty-stricken counties, accounting for nearly 50 per cent of the total number of poverty-stricken counties in China in 2019. The business covers 43 national demonstration counties for rural revitalization and 42 national key support counties for rural revitalization, vigorously promoting the revitalization of impoverished rural areas. In terms of variety selection, the "insurance + futures" pattern prioritizes agricultural varieties in poverty-stricken areas. As of June 30, 2023, in terms of professional assistance, futures operating institutions have provided price protection for 18 varieties in poverty-stricken areas, including natural rubber, corn, soybeans, eggs, apples, cotton and sugar, with a cumulative insured value of RMB 134.604 billion through the "insurance + futures" pattern[3].

3.1.2. Cost Control Mechanism

The high rate of agricultural disasters and the complexity of the work involved in carrying out agricultural insurance have led to relatively high pricing of agricultural insurance premiums. As a result, agricultural insurance premiums are a large and unaffordable expense for farmers in "insurance + futures" pilot areas, especially in poor areas. Without external support, farmers are unwilling and unable to participate in the pilot "insurance + futures" pattern. In order to control the premiums cost expenditure for farmers, the source of premiums has taken the form of multi-party commitment. Agricultural premiums in the pilot areas are mainly covered by government subsidies and futures exchanges. According to the website of China Futures Association, so far in 2016, the "insurance + futures" program has invested a total of RMB 6.72 billion in premiums, of which the futures exchanges supported a premium of RMB 2.185 billion, accounting for 32.51%; The insured participating entities self-paid premiums of RMB 2.044 billion, accounting for 30.42%; The government subsidized insurance premiums of RMB 2.033 billion, accounting for 30.25%; The futures companies donated a premium of RMB 296 million, accounting for 4.40%. It can be seen that farmers only bore about 30% of the premiums, which directly reduced the premium costs of poor households,

[3] The data is from the official website of China Futures Association.

 doi:10.20944/preprints202503.0183.v1

resulting in a high payout rate of 219.81% of the farmers' self-paid premiums, greatly promoting farmers' enthusiasm, and increasing the net household income of farmers. From 2022 to 2023, the government provided financial subsidies of RMB 875 million, accounting for 37.35%, which has become the biggest driving force in promoting the application of the 'insurance + futures' pattern.

3.1.3. Income Security Mechanism

The "insurance + futures" pattern spreads the risks faced by farmers and protects their income through the combination of the insurance market and the futures market. To put it simply, in this pattern, the insurance companies first design agricultural futures price insurance based on the futures prices of agricultural products announced by the futures exchanges; After that, farmers (or agricultural production cooperative organizations) transfer their own risks by purchasing the developed futures price insurance products from the insurance companies; The insurance companies purchase the over-the-counter (OTC) options on the underlying agricultural futures contracts from futures companies as the subject matter for "reinsurance" to avoid huge losses in insurance claims; The futures companies then use their own professional advantages to hedge their risks in the futures market.

From a single product perspective, the sales revenue of agricultural products depends on the sales price and sales volume. Assuming that the production volume equals the sales volume, the sales revenue depends on the sales price and the production volume. Therefore, the following is an analysis of how the “Insurance+Futures” pattern ensures the income of farmers from two perspectives:

Price Effect

The transfer of farmers' risk in the "insurance + futures" pattern is realized through the purchase of agricultural futures price insurance. The core element of this insurance is the target price (also known as the insurance agreement price) which corresponds to the exercise price of over-the-counter options. The target price serves as the basis for designing insurance terms and compensation. Assuming P_t is the target price and P_s is the harvest price, also known as the settlement price, according to the "insurance + futures" pattern the market can realize the guaranteed price as followed:

$$\text{guaranteed price} = \max(P_t, P_s) \quad (1)$$

Specifically, when the harvest price of agricultural products is higher than the target price, farmers can sell them at the harvest price without touching insurance claims; When the harvest price is lower than the target price, insurance claims will be triggered, and farmers can receive differential compensation as followed:

$$\text{unit compensation price} = (P_t - P_s) \quad (2)$$

$$\text{Total compensation amount} = (P_t - P_s) * \text{underwriting total production} \quad (3)$$

Currently, the total revenue equals the proceeds from selling at the target price. Overall, the final effect can be achieved is that farmers sell products at a price greater than or equal to the target price, which indicates the price of the bottoming out effect is strong. Under the premise of unchanged production, higher prices are conducive to higher incomes for farmers, and farmers are no longer affected by the "low grain prices hurt farmers" effect.

Yield Effect

As the "insurance + futures" pattern has the above-mentioned role of price support, eliminating the farmers' fear of the risk of downward price fluctuations, it will enhance the farmers' enthusiasm for planting or raising agricultural products, leading to an expansion in the area (or quantity) of planting or raising, resulting in an increase in production, and thus expanding the farmers' income. According to Martin Fishbein & Icek Ajzen's (1975) Theory of Planned Behavior, intrinsic

 doi:10.20944/preprints202503.0183.v1

psychological activity has an impact on behavioral willingness. The price support effect of "insurance + futures" pattern can help farmers eliminate the obstacles of planting risks and generate positive planting willingness, thus expanding the area of crop planting. Studies have confirmed this conclusion. For example, Rui Fang et al. (2019) used a Logit regression model to empirically analyze and confirm that the "Insurance+Futures" pilot program can effectively improve the enthusiasm of farmers for grain cultivation. Zhaoying Ding(2023) used Cobb-Douglas production function to analyze theoretically and found that the pilot "insurance + futures" pattern can positively affect the enthusiasm of farmers to plant food, thereby increasing the agricultural output. This was confirmed by his empirical analysis.

3.2. Hypothesis

In summary, the following hypothesis is proposed:

The pilot of the "Insurance+Futures" pattern has the potential to contribute to poverty reduction in rural areas.

4. Empirical Analysis

4.1. Samples and Data Sources

This paper uses annual data from 10 provinces in China from 2010- 2021 as samples of balanced panel data. These provinces are: Hunan Province, Yunnan Province, Shandong Province, Henan Province, Heilongjiang Province, Gansu Province, Guangdong Province, Liaoning Province, Xinjiang Uygur Autonomous Region, and Hebei Province. The reason why these 10 provinces are chosen as the targets of the cross-section is that they are the top 10 provinces in terms of the underwriting value of the "insurance + futures" pattern during the period from 2016 to July 2023[4] . It can be considered that they are the 10 provinces with the largest running scale of the "Insurance+Futures" pattern, and the research on them has typical significant value. The data on per capita disposable income in rural areas, rural population, total sown area of crops, and local financial expenditures on agriculture, forestry and water affairs in each province are sourced from the official website of the China Statistics Bureau, while the data on other indicators are obtained from the database of WIND.

4.2. Model Design and Variables Description

4.2.1. Modeling

In order to study the impact of the application of the "insurance + futures" pattern on the degree of rural poverty, this paper sets up the following basic regression model:

$$pov_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 Z_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (4)$$

In model (4), i represents the province and t represents the year. pov_{it} is the dependent variable representing rural poverty extent of the province i in year t. X_{it} is the core explanatory variable representing the operation scale of the "Insurance+Futures" pattern of the province i in year t. Z represents a set of control variables. μ_i denotes the fixed effect of a province that does not change with the province; λ_t denotes the fixed effect of years that does not vary with individuals; ε_{it} is a random disturbance term. β_0 represents the intercept term; β_2 is the regression coefficient of the control variables; β_1 is the regression coefficient of the core explanatory variables, reflecting the extent of the impact of the "Insurance+Futures" pattern running on rural poverty, which is the main focus of this paper.

[4] The ranking information here is reported on the official website of the China Futures Association. The URL is: http://www.cfachina.org/aboutassociation/industrypovertyalleviation/povertyalleviationtrends/202307/t20230705_46229.html

 doi:10.20944/preprints202503.0183.v1

4.2.2. Description of Variables

(1) Explained Variable

The dependent variable of this paper is the extent of rural poverty in the sample provinces. There are multiple methods in existing literature for measuring poverty. Firstly, the single dimension is measured by the per capita income. According to the explanation of indicators by the National Bureau of Statistics of China[5], the poverty standard also changes with economic and social development and living standards in different historical periods. So far, China has adopted three poverty standards: the first is the "1978 standard", which is a low-level survival standard, priced at RMB 100 yuan per person per year in 1978; The second is the "2008 standard", which is the basic food and clothing standard, priced at RMB 1196 yuan per person per year in 2008. The third is the "2010 standard", which is a stable standard for food and clothing, with an annual living standard of RMB 2300 yuan per person at the 2010 price. Secondly, the FGT index is compiled based on per capita disposable income for measurement. For example, Feili Tian, Fei Chen (2014) and others took this method to measure rural poverty degree. Thirdly, measurement for poverty is to construct a poverty index by considering poverty factors from multiple dimensions. For example, Alkire (2007) considered the individual or household levels in multiple dimensions such as health, income, hygiene, education, and living standards to construct the MPI index for measurement.

In this paper, the per capita disposable income of rural areas in each province is chosen as a proxy variable for the extent of rural poverty in each province, taking full account of data availability and the fact that the pilot projects of the "insurance + futures" pattern are all in rural areas. From the perspective of multidimensional poverty, resident income is the most intuitive and important dimension for measuring multidimensional poverty. Given that the standard for the impoverished population is defined by per capita income, if the per capita disposable income of a rural resident increases, the impoverished population will decrease, and also the degree of the poverty will decrease. Therefore, this study argues that if it can be shown that the "insurance + futures" pattern contributes to higher per capita disposable incomes in rural areas of the pilot provinces, it will also prove that the pattern has a poverty-reducing effect.

(2) Core explanatory variable

The core explanatory variable in model (4) is the scale of operation of the "insurance + futures" pattern. Theoretically, the insurance underwriting value of the pilot region of the "insurance + futures" pattern can measure the scale of the "insurance + futures" operation in the region. However, since neither the Futures Association nor other relevant databases published this indicator for each province, existing studies have adopted other indicators as proxies. For example, Rui Fang et al. (2020) used 0 and 1 dummy variables to measure, with the value of 1 in the year with the pilot project, and the value of 0 in the year without the pilot project; and Zhaoying Ding (2023) adopted the ratio of financial subsidies related to agriculture to the total fiscal expenditure. This paper also adopts a dummy variable to measure the operation scale of the "insurance + futures" pattern, taking the value of 1 if a province carries out the pilot of "insurance + futures" project in a certain year, and 0 otherwise. According to the theoretical analysis, the coefficient of this variable is expected to have a positive sign.

(3) Control variables

In addition to controlling the year and province for fixed effects, this paper also incorporates the following control variables based on existing literature:

① Total power of agricultural machinery. This variable represents the level of agricultural mechanization invested in the pilot area. The higher the indicator, the higher the level of investment in agricultural science and technology, and the more it promotes the increase of per capita disposable income of farmers. Therefore, the coefficient of this variable is expected to have a positive sign.

[5] Detail Source: the National Bureau of Statistics of China website http://www.stats.gov.cn/zt_18555/zthd/lhfw/2022/rdwt/202302/t20230214_1903576.html

 doi:10.20944/preprints202503.0183.v1

② Rural population. This variable represents the rural population in the pilot area。The higher the indicator, the lower the disposable income per capita, under the premise of keeping other factors unchanged. Therefore, the expected sign of this variable is negative.

③ Total assets of business outlets of small rural financial institutions. This indicator represents the level of rural financial development in the pilot area. Under the same conditions, the higher the level of rural financial development, the higher the level of disposable income of rural residents. Therefore, the expected sign of this variable is positive.

④ Local financial expenditure on agriculture, forestry and water affairs. This indicator represents the degree of financial support for agriculture by the government of the pilot region. And ceteris paribus, the higher the indicator, the higher the level of disposable income of rural residents. Therefore, the expected sign of this variable is positive.

4.3. Descriptive Statistics of Variables

Table 1 presents the descriptive statistics of the main variables in model (4). The paper uses balanced panel data for 10 provinces from 2010 to 2021, with no missing data. A total of 120 samples are included.

Table 1. Descriptive statistics of main variables.

variable name	variable symbol	mean	median	maximum	minimum	Standard deviation
rural disposable income per capita	POV	11321.06	11019.00	22306.00	3747.000	4103.511
"Insurance + Futures" pattern Pilot Variable	X	0.408333	0.000000	1.000000	0.000000	0.493586
total power of agricultural machinery	MECH	5528.846	3635.650	13353.02	1643.670	3577.454
rural population	POPUL	2741.300	2837.000	5784.000	1072.000	1330.685
total assets of business outlets of small rural financial institutions	ASSET	10569.52	7582.385	45550.00	1342.000	8708.802
Local financial expenditure on agriculture, forestry and water affairs	EXP	665.3064	667.8800	1145.400	196.2700	251.1144

4.4. Multicollinearity Test

It's important to check for multicollinearity between independent variables. Failing to do so could lead to incorrect conclusions when interpreting the model. VIF (Variance Inflation Factor) is a tool used to evaluate the degree of collinearity between variables in a regression model. If the VIF value is high (usually greater than 10), it indicates serious multicollinearity issues between certain

 doi:10.20944/preprints202503.0183.v1

variables in the model. After running by Eviews 10, the VIF coefficients of each independent variable in this model are shown in the Table 2. According to Table 2, the VIF value of each variable are relatively small, indicating no severe multicollinearity.

Table 2. VIF of independent variables.

variables	VIF
x	1.77
MECH	4.57
POPUL	1.67
ASSET	1.23
EXP	3.56
Average VIF	2.56

4.5. Main Regression Results and Analysis

In order to determine whether the panel data model (4) of this paper is better estimated by random effects or fixed effects methods, the Hausmann test is carried out, using Eviews 13.0 to run (the following model running software is the same as this), the test results are as follows in Tables 3 and 4. Table 3 tests the situation without adding control variables to the regression, and the results show that the P-value is less than 0.1, rejecting the null hypothesis. Therefore, a cross-sectional fixed effects model should be used in this situation. Table 4 tests the situation when all control variables are included in the regression, and the results show that the P-value is greater than 0.1. There is no evidence to reject the null hypothesis, and a cross-sectional random effects model should be used.

Table 3. Results of Hausmann's test (without the inclusion of control variables).

Test cross-section random effects			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	3.319843	1	0.0684

Table 4. Hausmann test results (with the inclusion of control variables).

Test cross-section random effects			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	5.905264	5	0.3155

Therefore, in Table 5, column (1) presents the estimated results of the cross-sectional fixed effects model; column (2) presents the estimated results using the cross-sectional random effects method. The choice of fixed or random effects for the year is similar, and will not be repeated below.

The benchmark regression results are shown in Table 5. Among them, column (1) presents the regression results without adding control variables, and column (2) presents the results with all control variables added. Column (1) shows the regression result of the core explanatory variable on the dependent variable. The coefficient of the running scale of the "Insurance+Futures" pattern is 5981.743, which is significant at the 1% level and in line with the expectation. The goodness-of-fit level is 0.7218. Column (2) reports the regression results with all control variables included. At this point, the coefficient of the running scale of the "Insurance+Futures" pattern is 1629.485, which is also significant at the 1% level and consistent with the expected sign, and the goodness-of-fit level is 0.8126. This indicates that the operation of the "Insurance+Futures" pattern has significantly

 doi:10.20944/preprints202503.0183.v1

contributed to the increase of disposable income in rural areas, which confirms the poverty alleviation effect of the "Insurance+Futures" pattern. In addition, the goodness-of-fit of the regression improved after the control variables were added, indicating that the added control variables are effective and they have reduced the endogeneity problems.

Table 5. Benchmark regression results.

variables	（1）	（2）
	POV	POV
X	5981.743***	1629.485***
	（13.7237）	（5.4671）
MECH		0.5346***
		（4.5062）
POPUL		-2.2537***
		（-5.5397）
ASSET		0.3110***
		（10.8322）
EXP		4.0216***
		（4.5640）
province fixed effect	YES	NO
year fixed effect	YES	YES
observations	120	120
R^2	0.7218	0.8126

Note: ***, **, * denote significant at 1%, 5%, 10% levels, respectively, and values in parentheses denote t-values (same as below).

As for the regression results of other control variables, as shown in column (2), they all passed the 1% significance test and the signs were consistent with expectations. The coefficient of total power of agricultural machinery (mech) is 0.5346, indicating that the improvement of agricultural mechanization level is significantly beneficial to the increase of per capita disposable income in rural areas; the coefficient of rural population is -2.2537, indicating that a decrease in rural population will significantly increase the per capita disposable income in rural areas; The coefficient of the total assets of the business outlets of small rural financial institutions is 0.3110, indicating that the improvement of rural financial level is significantly beneficial to the increase of per capita disposable income in rural areas; The coefficient of local fiscal expenditure on agriculture, forestry, and water affairs (exp) is 4.0216, indicating that an increase of local government financial support for agriculture will significantly improve the per capita disposable income level of local rural areas.

In summary, the benchmark regression results support the previous hypothesis that the pilot projects of the "Insurance+Futures" pattern have the effect of contributing to poverty alleviation in rural areas.

4.6. Robustness Test

(1) The explained variable is replaced with other proxy variables.

As the cooperation objects under the "Insurance+Futures" pilot projects are all related to agriculture, forestry, animal husbandry, and fishery, this pattern has a direct impact on the total output value of these industries. To test this, the dependent variable was replaced with the per capita total output value of agriculture, forestry, animal husbandry and fishery. The data was sourced from the Wind database. And the new regression results are shown in table 6:

 doi:10.20944/preprints202503.0183.v1

Table 6. Robustness test: regression results after replacing proxies for explained variables

variables	（1）	（2）
	POV	POV
X	1.0645***	0.3811***
	（10.9026）	（3.3854）
MECH		0.0003***
		（4.5062）
POPUL		-0.0007***
		（-5.5397）
ASSET		-0.000006
		（-0.6210）
EXP		0.0013***
		（3.8001）
province fixed effect	YES	NO
year fixed effect	NO	YES
observations	120	120
R^2	0.7891	0.4844

It can be seen that after replacing the proxy variables, the pilot of the "Insurance+Futures" pattern significantly promoted the increase in per capita agricultural, forestry, animal husbandry, and fishery output value. This suggests that the pilot of the “Insurance+Futures” pattern played a significant role in promoting rural poverty alleviation.

(2) The samples are replaced for testing.

As of July 2023, the pilot project of the "Insurance+Futures" pattern has been implemented in 31 provinces, autonomous regions, and municipalities directly under the central government. Due to limitations in data availability, it is not possible to accurately measure the operational scale data of the "Insurance+Futures" pattern. Therefore, this paper employs dummy variables of 0 and 1. To mitigate the influence of dummy variables on the outcomes, this paper previously selected the top 10 provinces with the highest underwriting value rankings for the "Insurance+Futures" project as cross-sectional samples. Although the results above support the hypothesis of this paper, they do not necessarily indicate consistency with other samples. Therefore, this paper randomly selected data from 10 other provinces from 2010 to 2021 as samples for testing. These 10 provinces include Inner Mongolia Autonomous Region, Guangxi Zhuang Autonomous Region, Hubei Province, Qinghai Province, Ningxia Hui Autonomous Region, Guizhou Province, Shaanxi Province, Chongqing City, Jilin Province, and Shanxi Province. All indicators’ data, except for the total asset value data of small rural financial institution branches sourced from the Wind database, were obtained from the official website of the National Bureau of Statistics of China. The results of the regression are displayed in Table 7. Table 7 shows that, after replacing the samples, although the running scale of the "Insurance+Futures" pattern in the other 10 provinces is not as large as in the 10 provinces in the main regression model, which leads a decrease in the significance level of their control variables, the coefficient of the core explanatory variable is still significantly positive at the 1% level. This proves that after changing the samples, the regression results continue to confirm that the "Insurance+Futures" pattern has significantly contributed to reducing rural poverty.

Table 7. Robustness test: regression results after replacing samples

variables	（1）	（2）
	POV	POV

 doi:10.20944/preprints202503.0183.v1

X	5927.051*** （15.3272）	2058.594*** （4.9279）
MECH		0.8457** （2.5326）
POPUL		-3.7376 （-0.8872）
ASSET		0.43580* （1.8347）
EXP		3.5439* （1.9434）
province fixed effect	NO	YES
year fixed effect	YES	NO
observations	120	120
R^2	0.6643	0.8824

In summary, the conclusion of the regression remains unchanged after replacing the proxy variables and samples. Therefore, it is believed that the main regression model's conclusion, that the “Insurance+Futures” pattern significantly promotes rural poverty alleviation, is robust.

4.7. Mechanism Test

According to the theoretical analysis, the role of the "Insurance+Futures" pattern in promoting rural poverty reduction is realized through ways such as prioritization of impoverished areas, cost control and income security. These mechanisms are empirically tested below. Due to limited data availability, only the yield effect in the income guarantee mechanism is tested below. In the following text, crop yield is chosen as the mediator variable. To test the yield effect, this paper adopts a mediation effect test procedure and sets up the following two models:

$$AREA_{it} = a_1 + b_1 X_{it} + c_1 \mathrm{Z}_{it} + \varepsilon_{it} \quad (5)$$

$$Pov_{it} = a_2 + b_2 AREA_{it} + b_3 X_{it} + c_2 \mathrm{Z}_{it} + \varepsilon_{it} \quad (6)$$

In model (5) and model (6), the variable AREA represents the total sown area of crops, as a proxy variable for the total output of all crops, and the data are sourced from the Wind database. The variable X represents the running scale of the "insurance + futures" pattern, and the data of X are taken in the same way as the main regression model (4). The POV variable is consistent with the meaning of the main regression model, which represents the degree of rural poverty. Z represents a set of control variables, which is also consistent with the main regression model. Here the per capita disposable income in rural areas is also used as a proxy variable for POV. The regression results of model (5) and model (6) are shown in Table 8:

Table 8. Mediation effect test: yield effect.

variables	model（5）	model（6）
	AREA	POV
X	142.5592*** （2.2628）	1606.545*** （5.4343）
AREA		1.1573*** （2.7934）
MECH	0.1843***	0.3721**

 doi:10.20944/preprints202503.0183.v1

	（6.0578）	（2.5997）
POPUL	0.1515	-3.5405***
	（1.0037）	（-5.4975）
ASSET	-0.0062	0.2920***
	（-0.8461）	（9.3448）
EXP	0.9293***	2.4000**
	（4.3796）	（2.4499）
province fixed effect	NO	NO
year fixed effect	YES	YES
observations	120	120
R^2	0.9975	0.9529

In Table 8, the regression results of model (5) indicate that the operation of the "Insurance+Futures" pattern significantly promotes the increase of total crop yield at the 1% level, indicating the existence of a yield effect. The regression results of model (6) indicate that both the "Insurance+Futures" pattern variable and the crop yield variable significantly promote the increase of per capita disposable income in rural areas, that is, promote rural poverty reduction. This suggests the existence of a partial mediation effect which is significant.

5. Conclusions and Insights

5.1. Conclusions

Numerous case studies have proven that the "Insurance+Futures" pattern has the effect of guaranteeing farmers' income and promoting rural poverty alleviation, but there is a lack of relevant data evidence to support this claim. This paper sorts out the poverty reduction mechanism of this pattern, and uses actual data from the top 10 provinces in China with the highest underwriting value in the "Insurance+Futures" pattern since 2016 to test it by a panel data model. The results show that the “Insurance+Futures” pattern has a significant effect on reducing poverty. By replacing the proxy variable for the dependent variable and changing the samples for testing, yet the results remained significantly valid, demonstrating the robustness of the conclusion.

5.2. Insights

The findings of this paper provide empirical evidence for China's further application of the "insurance + futures" pattern for rural poverty alleviation, and also give us some insights: firstly, this pattern deserves to be continuously promoted in the future. We should continue to increase the application of the "insurance + futures" pattern in relatively impoverished rural areas, and form a publicity organization that can operate on a long-term basis, so as to continuously improve farmers' awareness and motivation to participate in the pattern. Secondly, the existing "insurance + futures" pattern should be continuously improved. According to the existing literature, the current "insurance + futures" pattern is facing issues such as unstable premium sources, high risk management pressure on futures companies, and fluctuation of basis difference risk. These issues are affecting the sustainable operation of the pattern. Therefore, it is recommended that the government promulgate and implement a unified and stable policy on premium subsidies in the future; expand the relevant futures varieties to increase the options for futures companies to hedge their risks; explore innovative modes for insurance funds to enter the futures market under this pattern; and explore more "insurance + futures" enhanced pattern to solve the basis difference risk.

References

 doi:10.20944/preprints202503.0183.v1

1. Ruoxiang Jia, Xiaoli Hou (2011). New Pattern of Distribution and Distribution Characteristics and Types of Major Poverty Areas in China. *Party and Government Cadres Reference*（in Chinese ）, NO.(08):17-18.
2. Sun,Rong&Xu,bin (2016). The Origins of Agricultural Future Prices and its Inspiration to China: an Analysis based on Agricultural Future and Income Insurance, *Proceedings of the 2016 International Conference on Insurance and Risk Management in China* ,67-83.
3. Chen,Fang (2023). Research on Optimizing and Improving the "Insurance +Futures" Model——also Discussing the Application of Futures Prices in Agricultural Income Insurance. *China's Futures Industry Research on Innovation and Risk Management*， Beijing: China Financial and Economic Publishing House (in Chinese) ,405-436.
4. Makki，S.S., Somwaru，A. (2001). Evidence of Adverse Selection in Crop Insurance Markets. *Journal of Risk&Insurance*, 68(4):685-708.
5. Smith, V. H. . (2003). Federal Crop and Crop Revenue Insurance Programs: Income Protection. *Briefings*, 192(4235): 123.
6. Dismukes R , Coble K H(2006) .Managing Risk With Revenue Insurance. *Feature, Originally published,* 4(5):6-11.
7. Xu, Jing-Feng, Pu, L. (2014). Crop Insurance, Premium Subsidy and Agricultural Output. *Journal of Integrative Agriculture* ,13(11):253-254.
8. Goodwin, B.K., Hungerford, A. (2015). Copula-Based Models of Systemic Risk in U.S. Agriculture: Implications for Crop Insurance and Reinsurance Contracts. *American Journal of Agricultural Economics*, 97(3):879-896.
9. Ramsey, A. F. , Goodwin, B. K. , & Ghosh, S. K. . (2019). How High the Hedge: Relationships between Prices and Yields in the Federal Crop Insurance Program. *Journal of Agricultural and Resource Economics*, 44(2):227-s9.
10. Frascarelli, Angelo , S. D. Sarto , and G. Mastandrea (2021) . A New Tool for Covering Risk in Agriculture: The Revenue Insurance Policy.*Risks*,9（7）：131.
11. Chalise, L. , Coble, K. H. , Barnett, B. J. , & Miller, J. C. . (2017). Developing Area-triggered Whole Farm Revenue Insurance. *Journal of Agricultural and Resource Economics*, 42(1), 27-44.
12. Hennessy, D. A. , & Hayes, B. D. J. . (1997). Budgetary and Producer Welfare Effects of Revenue Insurance. *American Journal of Agricultural Economics*, 79(3), 1024-1034.
13. Bielza, M. , Garrido, A. , & Sumpsi, J. M. . (2002). Revenue Insurance as an Income Stabilization Policy: an Application to the Spanish Olive Oil Sector. *General Information*, (02):28-31
14. Tiemtore, A. . (2021). Examining the Effects of Agricultural Income Insurance on Farmers in Burkina Faso. *Geneva Papers on Risk and Insurance - Issues and Practice* (1), 1-18.
15. Ahmed, O. , & Serra, T. . (2015). Economic Analysis of the Introduction of Agricultural Revenue Insurance Contracts in Spain Using Statistical Copulas. *Agricultural Economics*, 46(1), 69-79.
16. Kim, S. , Sim, Y. , & Seo, S. . (2021). Analysis of Income Stabilization Effect and Fiscal Efficiency of Korean Crop Revenue Insurance. *The Korean Journal of Agricultural Economics*. 62 (2) :135-153.
17. Cole, J. B. , & Gibson, R. . (2010). Analysis and Feasibility of Crop Revenue Insurance in China. *Agriculture and Agricultural Science Procedia*, 1(156):136-145.
18. Tingting Cao, Yongbo Ge (2018). Innovative Initiatives of Financial Poverty Alleviation in China--Taking Apples' "Insurance+Futures+Banks" as an Example. *Financial Theory & Practice*（in Chinese）,NO.(12):90-96.
19. Jiuyang Liu (2022). Research on the Innovative Pattern of "Insurance + Futures" for Financial Precision Poverty Alleviation. Dissertation from Zhongnan University of Economics and Law （ in Chinese）.
20. Xinci Zhao (2022). Research on How the "Insurance + Futures" Pattern Helps Precise Poverty Alleviation. *Dissertation from* Liaoning University （in Chinese）.

 doi:10.20944/preprints202503.0183.v1

21. Wenxuan Hu (2023). Research on How the Pattern of "Insurance + Futures" of Peanut in Runan County helps accurate poverty alleviation. *Dissertation from Guangzhou University* （in Chinese）.
22. Yangyang Li, Jianjun Huai (2023). The "Insurance + Futures" Pattern and Farmers' Income Increase - A multi-period double-difference Estimation based on 124 counties in China. *Chinese Journal of Agricultural Resources and Regional Planning*（in Chinese）, 44(08):134-144.
23. Chenguang Guo, Xueping Xiong (2021). Fully Play the Service Function of Futures Market on Agricultural and Rural Modernization. *Issues in Agricultural Economy*（in Chinese）, NO. (3): 75 - 87.
24. Yuanyuan Xu, Jian Li, Linjie Wang(2022). "Insurance + Futures" Service for Price Risk Management of Local Advantageous and Characteristic Agricultural Products--Operating
25. Mechanism, Outstanding Problems and Policy Integration Space. *Issues in Agricultural Economy*（in Chinese）,NO. (01):114-127.
26. Martin Fishbein & Icek Ajzen (1975). Belief, Attitude, Intention, and Behavior: an Introduction to Theory and Research, *Addison-Wesley Publishing Company*, 53.
27. Rui Fang, Yi An, Wenchao Liu (2019). Can the pilot project of "Insurance + Futures" Improve Farmers' Incentive to Grow Grain? --An Analysis Based on the Mediating Effect of Farmers' Willingness to Participate and the Moderating Effect of Government Subsidy Satisfaction. Chinese Rural Economy （in Chinese） ,NO(06):113-126.
28. Zhaoying Ding (2023). Research on the Impact of "Insurance + Futures" on Agricultural Production. Dissertation from Anhui University of Finance and Economics （in Chinese）.
29. Feili Tian, Fei Chen(2014). Research on the Measurement of Rural Poverty Index and Policy Poverty Alleviation Effect in China. Journal of Dongbei University of Finance and Economics（in Chinese）,NO.(04):64-71
30. Alkire S (2007). The missing dimensions of poverty data: Introduction to the special issue. *Oxford development studies*, 35(4): 347-359.