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Research Article

The Impact of Social Security on the Multidimensional Poverty of Rural Households in China

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Abstract: Drawing on panel data spanning 2010 to 2020 from the China Family Panel Studies (CFPS) and applying the Propensity Score Matching combined with the Difference-in-Differences (PSM-DID) approach, this study assessed the effectiveness of social security mechanisms in mitigating poverty among rural households, with particular attention to educational attainment, health conditions, and living standards. The empirical results demonstrate that social security provisions play a substantive role in reducing deprivation across these dimensions for rural populations. Moreover, the magnitude and nature of these effects are not uniform, as social security measures exhibit differentiated impacts on various poverty dimensions across China's Eastern, Central, and Western regions.

Keywords: Social Security; Educational Poverty; Health Poverty; Living Standard Poverty; PSM-DID.

1. Introduction

Following the historical eradication of absolute poverty, China's poverty governance agenda has progressively reoriented towards mitigating relative deprivation arising from uneven and insufficient development, marking a shift from a unidimensional income-based perspective to a multidimensional poverty framework. In comparison with urban contexts, rural poverty remains more acute, as rural households experience deeper and more persistent constraints related to economic protection, health preservation, access to medical services, and the enhancement of living standards. Within this context, social security constitutes both a core objective of poverty alleviation and a central institutional mechanism for rural anti-poverty practice in China [1]. It simultaneously seeks to secure basic subsistence, broaden developmental opportunities, and improve long-term welfare prospects for rural residents [2]. The programme was initially introduced nationwide on a pilot basis in 2009 to address rural poverty challenges and reached universal coverage by 2012, with implementation in rural areas now exceeding a decade.

The role of social security as an instrument for rural poverty reduction has attracted substantial scholarly attention [3; 4]. Key questions persist regarding whether social security effectively alleviates poverty among rural households, the channels through which it influences rural deprivation, and whether its poverty reduction effects vary across different population groups. Addressing these issues requires rigorous and systematic evaluation of the poverty alleviation outcomes associated with social security, which is essential for strengthening the system itself, advancing rural poverty governance, and promoting the broader objective of common prosperity. Existing studies have extensively examined the consequences of social security implementation, particularly its effects on income and consumption.

Empirical evidence suggests that social security not only increases the income levels of participating households but also contributes to a more equitable distribution of income within families. Analyses based on household survey data further indicate that the system exerts a strong catalytic and enabling influence on daily consumption among insured households [5]. In addition, its implications for labour supply have been documented, with eligible recipients tending to reduce working hours and labour input, especially within agricultural activities [6]. Beyond these dimensions, numerous studies have explored its impact on poverty outcomes, demonstrating that, owing to its inclusive and non-discriminatory coverage, social security mitigates difficulties associated with identifying poverty targets, raises residents' incomes, enhances physical health and life satisfaction in later life, and reduces the incidence and depth of poverty [3].

Conversely, some scholars argue that limited coverage and relatively low benefit levels constrain the effectiveness of social security in alleviating income poverty, while its influence on health outcomes and subjective well-being may be negligible. Overall, although the poverty reduction effects of social security have been widely examined, with increasing emphasis on multidimensional poverty, existing findings remain inconsistent, and systematic heterogeneity analyses of policy impacts are largely lacking. Further theoretical refinement and empirical investigation are therefore required to clarify whether social security produces meaningful poverty alleviation effects and to elucidate the mechanisms through which such effects operate.

Against this backdrop, the present study employs panel data from CFPS for the period 2010 to 2020 and applies the PSM-DID approach to evaluate the impact of social security on health poverty, educational poverty, and living standard poverty among rural households. The analysis not only assesses whether the system reduces multidimensional poverty in rural settings but also examines heterogeneity in its poverty alleviation effects across different groups and regions. Compared with existing research, this study makes three principal contributions. First, in terms of poverty measurement, it moves beyond a single-dimensional focus by incorporating health, education, and living standards as distinct dimensions. Second, through heterogeneity analysis, it investigates variations in the poverty governance role of social security across groups and regions. Third, from a methodological perspective, the application of PSM-DID addresses endogeneity arising from observable characteristics and omitted variables, thereby improving the robustness and accuracy of the empirical estimates and research conclusions.

2. Literature Review

As a central instrument of social policy, social security has played a significant role in poverty reduction and the promotion of social equity. With the continuous refinement of social security arrangements in recent years, an expanding body of research has examined its influence on educational poverty, health poverty, and living standard poverty. A social security system can be understood as an institutional framework designed to

safeguard basic living conditions by providing financial assistance and access to social services [7]. The Social Risk Management theory (SRM) advanced by Holzmann and Jørgensen [8] emphasises the capacity of social security to stabilise household income, offer protection against risks associated with ageing and healthcare, and enable households to manage uncertainty more effectively. Through these mechanisms, social security contributes to improved financial security and enhances overall quality of life. More broadly, the objectives of social security encompass poverty eradication, the reduction of social disparities, the stimulation of economic development, and the improvement of population living standards.

2.1 Poverty of Education and Social Security

Educational poverty refers to a condition in which individuals or groups experience significant disadvantages in access to educational opportunities, the availability of learning resources, and the overall quality of education [9]. This concept extends beyond the mere absence of basic schooling to include deficiencies in instructional quality and inadequacy of educational inputs. In the development of the Multidimensional Poverty Index (MPI), [10] emphasise that poverty can only be fully understood when its multiple dimensions are comprehensively considered. Educational deprivation has long-term implications for individuals' future income prospects, health outcomes, and social participation, thereby reinforcing the intergenerational persistence of poverty.

Through financial support mechanisms such as pensions, health insurance, and public service provision, social security directly alleviates household economic pressures, enabling families to allocate greater resources to their children's education. Empirical evidence provided by Cai and Cheng [11] demonstrates that the establishment of social security systems substantially increased household expenditure on education, thereby improving children's access to schooling. Medical insurance, as a core component of social security, further reduces the healthcare burden faced by families and safeguards students' health, which in turn lowers school absenteeism associated with illness.

Consistent with this Liu ,Rao [12] find that the widespread adoption of rural medical insurance significantly reduced school dropout rates by supporting the continuity of education among rural students. In addition, social assistance policies enhance the living conditions of disadvantaged households by providing financial transfers that expand educational opportunities for children. Ringen and Ngok [13] further indicate that social assistance not only raises household living standards but also exerts a direct influence on the educational attainment of students from low-income families through targeted measures such as subsidies and scholarships.

H1: Social security reduces educational poverty among rural households.

2.2 Social Security and Health Poverty

Health poverty constitutes a complex and multi-layered phenomenon shaped by interrelated biological, economic, and institutional factors. At a fundamental level, inadequate nutrition and the prevalence of disease significantly undermine labour productivity, thereby constraining income generation and reinforcing poverty [14]. In addition, deficiencies in public health expenditure and inefficiencies in government intervention are widely recognised as major contributors to health-related deprivation [15]. Empirical research indicates that following the latest wave of healthcare reforms, aggregate government health spending has generated notable poverty reduction effects on multidimensional health poverty among Chinese residents, with these effects being more pronounced in rural areas. However, the effectiveness of health poverty alleviation policies is moderated by several constraints, including misalignment between policy objectives and local needs, overly optimistic assumptions regarding medical insurance coverage, and limited participation or utilisation rates [16]. Health poverty therefore not only compromises individual and household welfare but also exerts enduring adverse effects on long-term socioeconomic development.

Prolonged exposure to poverty inflicts lasting harm on individual health, heightening susceptibility to persistent deprivation and perpetuating poverty traps. At the societal level, health poverty intensifies inequality and obstructs the pursuit of social equity and justice [17]. Health insurance, as a core component of social security, plays a critical role in mitigating household financial pressure by covering medical expenditures and safeguarding individuals' rights to health. Evidence provided by Liu ,Rao [12] shows that the widespread implementation of rural health insurance substantially improved health outcomes among rural populations and significantly reduced incidences of poverty induced by illness. Complementary findings by Hannum ,Liu [14] further demonstrate that improvements in nutritional intake and overall health status markedly enhanced productivity and income levels among rural households.

From a broader policy perspective, population healthcare expenditure has been shown to exert a strong mitigating influence on multidimensional health poverty in China, particularly by improving rural health conditions and constraining health-related deprivation [15]. A series of government interventions targeting health poverty, including the provision of free medical services, medical subsidies, and health education programmes, have played a pivotal role in this process. Nevertheless, Wang ,Yip [16] underscore that although health poverty alleviation policies are effective in improving health outcomes among poor rural households, their implementation is often hindered by insufficient financial resources and weak enforcement mechanisms. Improvements in health not only directly enhance individual quality of life, but also reduce household vulnerability to poverty associated with illness. Using rural data from the CHNS, Yu [17] provides evidence that rising health status significantly lowered poverty vulnerability among rural households, thereby curbing the incidence of health-induced poverty. Collectively, these findings underscore the critical importance of effective healthcare policies and sustained investment in promoting social equity, economic development, and overall societal wellbeing.

H2: Social security does not decrease health poverty in rural households.

2.3 Social Security and Living Standard Poverty

Poverty related to social security and living standards, often described as livelihood poverty, refers to a condition in which individuals or households are unable to meet their basic living needs. This form of deprivation extends beyond a deterioration in quality of life and may generate persistent adverse consequences for social stability and long-term economic development. Poor households frequently experience inadequate housing conditions, with many low-income families residing in dilapidated or substandard dwellings, or in extreme cases lacking secure housing altogether. This issue is particularly pronounced in rural China where, despite an apparent surplus of vacant housing, a large proportion consists of high-end properties that remain financially inaccessible to middle- and low-income households [18]. In addition, the perceived quality of living standards among disadvantaged populations tends to be low, and such groups often report reduced subjective life satisfaction, which stands in sharp contrast to their already constrained objective living conditions [19].

Livelihood poverty in rural China is also closely associated with deficiencies in basic infrastructure, particularly water availability. Many rural areas continue to experience persistent water scarcity, compounded by inefficient water conservation facilities, which makes access to safe drinking water a significant challenge. This constraint not only limits agricultural productivity but also negatively affects daily life and overall welfare. The strong linkage between poverty and water insecurity implies that addressing water-related issues is essential for improving living standards and fostering sustainable livelihoods among poor populations [20].

Energy poverty represents another critical dimension influencing the living standards of disadvantaged households. Existing studies identify access to energy services and the affordability of household energy consumption as two central indicators of energy poverty [21]. In rural contexts, financial constraints prevent many families from affording cleaner energy sources, compelling them to rely on traditional biomass fuels such as firewood and coal for cooking and heating. This reliance poses serious risks to physical health and simultaneously exacerbates environmental degradation [22]. Consequently, the interlinked challenges of water and energy poverty must be addressed in an integrated manner to support sustainable development and improve overall wellbeing in rural regions.

Within this framework, social security plays a pivotal role by implementing policies aimed at improving housing conditions, water accessibility, and energy use, including targeted subsidies and low-income housing support. Empirical evidence underscores the effectiveness of these interventions. Yu [17] reports that housing subsidy programmes substantially enhanced the quality of housing occupied by poor households, thereby reducing health risks associated with inadequate living environments. In parallel, social security initiatives have sought to improve household water conditions through the provision of clean water supplies and related infrastructure.

Further evidence provided by Li ,Li [23] indicates that fiscal investment and social security programmes have been particularly effective in expanding access to safe drinking water and sanitation facilities, especially in rural areas. Social policies have also supported low-income households in meeting their energy needs through subsidies for clean energy and the promotion of cleaner fuel alternatives. Cai and Cheng [11] demonstrate that policies encouraging clean energy adoption significantly reduced rural households' dependence on traditional fuels, resulting in improved living standards and better health outcomes. Collectively, these findings highlight the comprehensive role of social security in addressing multiple dimensions of livelihood poverty and

enhancing the overall quality of life among vulnerable populations.

H3: Poverty among rural households living under the living standard due to social security.

2.4 Poverty By Income and Education

Education exerts a substantial influence on the income prospects of farmers residing in geographically isolated and impoverished regions. Existing evidence indicates that investment in educational financing generates a consistently positive effect on farmers' earnings, with its contribution to poverty reduction exceeding that of many alternative policy instruments [24]. Beyond income enhancement, education has been shown to mitigate relative poverty within rural communities, particularly among individuals experiencing higher levels of multidimensional deprivation. These findings suggest that education not only improves material conditions but also enhances overall quality of life [25]. Consequently, education-led poverty alleviation is widely recognised as a critical pathway for addressing relative poverty.

Through the provision of educational services, the intergenerational transmission of poverty can be disrupted, thereby strengthening the capacity of disadvantaged populations to escape persistent deprivation. This function is especially significant in the post-poverty alleviation phase, during which policy priorities increasingly concentrate on resolving issues of relative poverty rather than absolute deprivation [26]. Nevertheless, the relationship between education and income inequality remains nuanced. On one hand, improvements in educational attainment can contribute to narrowing income disparities between urban and rural areas and across regions [27].

On the other hand, unequal distribution of educational resources may intensify income inequality. Strong linkages have been identified between family background, the allocation of educational opportunities, and disparities in income distribution [28]. This indicates that, to fully realise the poverty alleviation potential of education, greater emphasis must be placed on ensuring equitable access to educational systems and resources. In sum, education is fundamental not only to poverty reduction but also to sustained economic development. Effective strategies for leveraging education in poverty alleviation include increased investment in the education sector, more balanced distribution of learning resources, and enhanced financial support for disadvantaged groups. Equally important is the continuous evaluation of education-based anti-poverty policies, with timely adjustments to ensure their relevance and effectiveness as socioeconomic conditions evolve.

2.5 Income and Health Poverty

Existing empirical evidence consistently demonstrates that income growth plays a decisive role in poverty reduction. Studies show that the substantial decline in rural poverty in South Asia occurred predominantly and was largely driven by increases in household earnings [23]. Moreover, improvements in nutrition and health are closely associated with higher labour productivity, which in turn translates into increased income levels. This relationship indicates that policies aimed at raising both income and health status are effective instruments for poverty alleviation [14].

However, the expansion of income disparities generates adverse health consequences. A growing body of research indicates that widening income inequality intensifies health inequalities, with disproportionately negative effects on low-income populations. This suggests that while pursuing economic growth, equal attention must be given to the equity of income distribution to prevent the deepening of health disparities within society. In this regard, government expenditure on healthcare services has been shown to be particularly effective in reducing multidimensional health poverty, especially in rural contexts [15]. Furthermore, health insurance schemes can partially mitigate the risk of illness-induced impoverishment, with the strongest protective effects observed among low-income groups [29].

These findings imply that poverty alleviation strategies should incorporate increased investment in the healthcare sector alongside reforms that enhance the coverage, accessibility, and effectiveness of health insurance systems. Health and income therefore represent core determinants of poverty outcomes. Effective poverty reduction requires integrated interventions that raise income levels, improve population health, promote a more equitable income distribution, and strengthen health insurance mechanisms. Given the bidirectional relationship between income inequality and health, sustained efforts to narrow income gaps are essential for fostering healthier and more inclusive social and economic development.

2.6 Income and Living Standard Poverty

Income constitutes a central determinant of living standards and poverty outcomes. Existing literature emphasises that uneven income distribution contributes substantially to poverty, particularly in less developed regions, where wealth is highly concentrated among affluent households, while poorer households rely predominantly on unstable and low-growth income sources, often derived from small-scale or informal economic activities. Beyond financial resources, the accumulation of social capital has been identified as a significant factor in reducing poverty, enhancing the likelihood of escaping deprivation and decreasing the probability of falling back into poverty [26].

Housing, a fundamental human need, frequently becomes unaffordable for low-income households. Empirical research demonstrates a pronounced disparity in housing affordability across income groups. Housing assistance programmes have been shown to alleviate these pressures, reducing rental burdens and preventing homelessness among disadvantaged families [30]. Although direct evidence concerning access to water and cooking fuel is more limited, it is reasonable to infer that these essential resources are closely linked to household financial capacity. Economic constraints in impoverished households often result in insufficient or poor-quality water and fuel, undermining their ability to meet minimum daily living requirements. Income- and living standard-related poverty is therefore a multifaceted and interrelated phenomenon, encompassing disparities in income distribution, housing affordability, and access to necessities. Future research should investigate how improvements in income distribution, the accumulation of social capital, and the implementation of effective housing support interventions can collectively elevate living standards among disadvantaged populations and narrow poverty gaps more precisely [26]. Simultaneously, attention must be given to ensuring that poor households have secure access to essential resources such as water and cooking fuels, thereby safeguarding their basic standards of living.

3. Methodology

3.1 Date Resources

The CFPS, conducted by the Institute of Social Science Survey at Peking University, is designed to collect longitudinal data at the individual, household, and community levels. This dataset provides a comprehensive reflection of changes in Chinese society, economy, population, education, and health, encompassing provinces such as Fujian, Sichuan, and Jilin, and covering approximately 95% of the national population. Following two years of pilot surveys in 2008 and 2009, the CFPS commenced its official baseline survey in 2010, succeeded by five rounds of full-sample tracking surveys in 2012, 2014, 2016, 2018, and 2020. Annual data are systematically gathered across three regional divisions: Eastern, Central, and Western districts. Consequently, the dataset comprises 16,594 observations per variable, which form the basis for the empirical analysis conducted in this study.

3.2 Measurement of Each Variable

3.2.1 Dependent Variable

This study assesses the poverty alleviation effects of rural pension insurance across three dimensions: educational poverty, health poverty, and living standard poverty.

For educational poverty, two indicators are employed: years of education and children's school attendance. The threshold for years of education is based on China's 12-year compulsory education system. Households in which the average adult education level falls below 12 years are considered educationally deprived and assigned a value of 1; otherwise, they are assigned 0. For children's school attendance, the criterion is whether household members aged 6–16 are enrolled in the grade appropriate for their age. If any child falls below the age-appropriate grade, the household is classified as educationally deprived and assigned a value of 1; otherwise, it is assigned 0.

Health poverty is measured using three aspects drawn from the CFPS survey: self-assessed health status, presence of chronic diseases, and BMI indicators. Households are considered health-deprived (assigned a value of 1) if any member is diagnosed with chronic conditions such as hypertension, diabetes, stroke, or cancer; otherwise, they are assigned 0. BMI serves as an international measure of body fat and health status, with the standard adult range set between 18.5 and 24. If any household member aged 16 or above falls outside this range, the household is classified as health poor. Additionally, if any household member self-assesses as unhealthy, the household is identified as health poor.

Living standard poverty is based on indicators recommended by the UNDP and adapted to reflect rural household conditions, with three selected measures: cooking water, cooking fuel, and housing. Cooking water sources include river/lake water, well water, tap water,

bottled/purified/filtered water, rainwater, cistern water, and pond water; households using river/lake water, rainwater, or cistern water are considered deprived in cooking water. Cooking fuel types include firewood, coal, bottled gas/LPG, natural gas/pipeline gas, solar/biogas, and electricity; households relying on firewood or coal are classified as fuel poor. Finally, if household members lack full ownership of their housing, the household is regarded as housing poor. In all three cases, deprivation is assigned a value of 1, and non-deprivation is assigned 0.

3.2.2 Independent Variables

In this study, the independent variable, pension insurance, is defined as whether at least one household member is enrolled in any form of basic pension insurance, including the New Rural Social Pension Insurance (NRPS) or the Urban Residents' Pension Insurance. If a household has at least one enrolled member, the variable is assigned a value of 1; otherwise, it is assigned 0.

3.2.3 Control Variables

To more precisely examine the impact of pension insurance on multidimensional poverty among rural households, this study incorporates control variables as shown in Table 1 at the individual, household, and village levels, informed by existing research. At the individual level, the variables comprise gender (male = 1, female = 0), age, and marital status (married = 1, unmarried = 0). At the household level, the variable includes labour mobility, measured by whether any household member works outside the village (yes = 1, no = 0). At the village level, control variables include natural disasters (whether the village frequently experiences natural disasters; yes = 1, no = 0), transportation conditions (distance from the household to the nearest bus stop, in kilometres), and geographical conditions (shortest travel time from the household to the city centre, in minutes).

Table 1: Variable Definition

Variable	Symbol	Measurement
Dependent Variable		
Education Poverty	EP	Education poverty is assigned a value of 1, otherwise it is 0.
Health Poverty	HP	Health poverty is assigned a value of 1, otherwise it is 0.
Living Standard Poverty	LSP	Living standard poverty is assigned a value of 1, otherwise it is 0.
Independent Variable		
Social Security	SS	The family members participate in pension insurance, health insurance or receive government assistance, the assignment is 1, otherwise it is 0.
Control Variable		
Household Per Capita Income	INC	If the household per capita annual income is less than 50% of the per capita disposable income for that year, the value is 1; otherwise, it is 0.
Labour Mobility	LAB	If at family member works away from home, the value is 1; otherwise, it is 0.
Age	AGE	The age of the household head (in years).
Gender	GEN	The gender of the household head is assigned a value of 1 for males and 0 for females.
Marital Status	MAR	The marital status of the household head is assigned a value of 1 for married and 0 for others.
Disaster Area	DIS	The home location is in a natural disaster area, the assignment is 1, otherwise it is 0.
Transportation Condition	TRANSC	The distance from the household to the nearest bus stop, measured in kilometres.
Geographical Condition	GEOC	The shortest time from the household to the city centre, measured in minutes.

3.3 Empirical Model

Participation in social security by rural households is a voluntary decision influenced by factors such as age, education level, and income. Consequently, an effective evaluation of social security policies requires addressing issues of endogeneity and selection bias. Endogeneity may arise from the “adverse selection” problem inherent in the insurance market. Households exhibit considerable heterogeneity in their decision to participate; for example, those with poorer health are more likely to enrol in insurance. Following enrolment, these households may increase utilisation of medical services for minor ailments, potentially resulting in inefficient use of healthcare resources. Endogeneity may also result from reverse causality, whereby poverty itself can influence the extent of social security coverage.

To address the endogeneity associated with insurance participation among rural households, this study employs the PSM-DID method proposed by Heckman. The approach utilises the temporal differences before and after households participate in social security as the classification criterion, designating the period prior to participation (i.e., before policy implementation) as the control group and the households participating after implementation as the treatment group. Samples from the treatment and control groups are reselected and matched to minimise selection bias, thereby yielding more accurate estimates of poverty alleviation effects. The model employed in this study is specified as follows:

$$ATT_{PSM-DID} = E[Y_2^T - Y_1^T \mid X, D = 1] - E[Y_2^C - Y_1^C \mid X, D = 0]$$

ATTPSM-DID is the average treatment effect on the treated. YT 1and YT 2 represent the poverty incidence rates for the treatment group before and after the policy implementation respectively. YC 1 and YC 2 are the poverty incidence rates for the control group before and after the policy implementation respectively and D represents participation in social security, with a value of 1 indicating participation and 0 indicating non-participation.

As the independent variable in this study is social security and the dependent variables are educational poverty, health poverty, and living standard poverty—all measured as 0–1 dichotomous variables—the binary logit model is employed. This model enables an in-depth analysis of the relationship between social security and each dimension of poverty, while controlling for relevant factors at multiple levels: per capita household income and labour mobility at the household level; age, gender, and marital status at the individual level; and natural disaster exposure, transportation conditions, and geographical accessibility at the village level. Accordingly, the model examining the impact of social security on the three dimensions of rural household poverty is specified as follows:

$$\text{Logit}(\text{EP}_i) = \beta_0 + \beta_1 \text{SS}_i + \beta_2 \text{GEN}_i + \beta_3 \text{AGE}_i + \beta_4 \text{MAR}_i + \beta_5 \text{INC}_i + \beta_6 \text{LAB}_i + \beta_7 \text{DIS}_i + \beta_8 \text{TRANSC}_i + \beta_9 \text{GEOC}_i + \epsilon_i$$

$$\text{Logit}(\text{HP}_i) = \beta_0 + \beta_1 \text{SS}_i + \beta_2 \text{GEN}_i + \beta_3 \text{AGE}_i + \beta_4 \text{MAR}_i + \beta_5 \text{INC}_i + \beta_6 \text{LAB}_i + \beta_7 \text{DIS}_i + \beta_8 \text{TRANSC}_i + \beta_9 \text{GEOC}_i + \epsilon_i$$

$$\text{Logit}(\text{LSP}_i) = \beta_0 + \beta_1 \text{SS}_i + \beta_2 \text{GEN}_i + \beta_3 \text{AGE}_i + \beta_4 \text{MAR}_i + \beta_5 \text{INC}_i + \beta_6 \text{LAB}_i + \beta_7 \text{DIS}_i + \beta_8 \text{TRANSC}_i + \beta_9 \text{GEOC}_i + \epsilon_i$$

4. Results

Table 2 presents the descriptive statistics for the relevant variables in the 2010 and 2020 samples. The data reveal notable differences in the basic characteristics, as well as in the incidence and variability of poverty, between the treatment group (households participating in social security) and the control group (households not participating in social security). In 2010, the mean values of educational poverty (EP), health poverty (HP), and living standard poverty (LSP) in the treatment group were 0.018, 0.210, and 0.564, respectively, compared with 0.031, 0.241, and 0.566 in the control group. By 2020, these values in the treatment group had declined to 0.013, 0.375, and 0.219, respectively, while in the control group they were 0.024, 0.493, and 0.226, respectively.

Table 2: Descriptive Statistics Analysis

Variable	2010				2020			
	Treated		Control		Treated		Control	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
EP	0.018	0.132	0.031	0.175	0.013	0.114	0.024	0.153
HP	0.210	0.407	0.241	0.428	0.375	0.485	0.493	0.500
LSP	0.564	0.496	0.566	0.496	0.219	0.414	0.226	0.418
INC	0.083	0.276	0.063	0.244	0.151	0.359	0.210	0.407
LAB	0.368	0.483	0.373	0.484	0.448	0.498	0.467	0.499
AGE	49.271	11.419	50.211	12.046	51.313	9.175	51.389	12.009
GEN	0.797	0.403	0.818	0.386	0.615	0.487	0.628	0.484
MAR	0.879	0.327	0.913	0.282	0.914	0.281	0.895	0.307
DIS	0.345	0.476	0.314	0.464	0.326	0.469	0.295	0.456
GEOC	35.523	69.621	35.749	54.661	28.544	23.260	33.855	58.522
TRANSC	1.745	2.128	2.016	4.033	1.540	1.995	1.573	2.077

These results indicate that, at each time point, poverty indicators differed between the treatment and control groups. Households in the treatment group generally exhibited lower poverty incidence, particularly in education and living standards. However, the proportion of health poverty increased over time, suggesting a deterioration in the health status of the rural elderly population. In contrast, some dimensions of poverty in the control group, especially health and living standards, worsened over the same period, underscoring the positive role of social security in alleviating

multidimensional poverty.

4.1 Balance Test

To ensure the reliability of the PSM-DID evaluation, this study examines whether the distribution of variables between the treatment and control groups becomes more balanced following matching. One-to-one nearest-neighbour matching was employed, and the results are presented in Table 3. After matching, the standardized deviations of all variables are below 10%, the T-test results for most variables are not significant, and no substantial differences remain in the characteristics of the two groups. These findings indicate that, prior to matching, observable variables exhibited selection bias between the insured and control groups, which was substantially reduced after matching. The high quality of matching satisfies the balance assumption required for the propensity score matching (PSM) method, thereby enhancing the reliability of the social security treatment effect estimated using the PSM-DID approach. Additionally, the common support test shows that over 90% of the sample falls within the common support region, confirming that the common support assumption of PSM is met.

Table 3: Balance Test Before and After Sample Matching

Variable	Unmatched	Mean		%bias	T-Test	
	Matched	Treated	Control		T-Value	P-Value
INC	U	0.08311	0.0634	7.6	1.96	0.05
	M	0.08311	0.08646	-1.3	-0.23	0.818
LAB	U	0.36785	0.37281	-1	-0.25	0.799
	M	0.36785	0.36105	1.4	0.27	0.787
AGE	U	49.271	50.211	-8	-1.95	0.051
	M	49.271	49.295	-0.2	-0.04	0.969
GEN	U	0.797	0.81792	-5.3	-1.34	0.182
	M	0.797	0.80129	-1.1	-0.21	0.838
MAR	U	0.87875	0.91276	-11.1	-2.91	0.004
	M	0.87875	0.88288	-1.4	-0.24	0.807
DIS	U	0.34469	0.31386	6.6	1.64	0.101
	M	0.34469	0.32103	5	0.96	0.336
TRANSC	U	35.523	35.749	-0.4	-0.1	0.922
	M	35.523	34.341	1.9	0.38	0.707
GEOC	U	1.745	2.016	-8.4	-1.77	0.076
	M	1.745	1.575	5.3	1.54	0.124

4.2 The Poverty Alleviation Effect of Social Security on Rural Households

Table 4 presents the estimated effects of social security participation on educational poverty, health poverty, and living standard poverty among rural households, using Models 1, 3, and 5, respectively, with Models 2, 4, and 6 controlling for relevant variables. Regarding educational poverty, the results indicate that social security participation has a significant alleviating effect. In Models 1 and 2, the coefficients for the interaction term between time and social security (TIME × SS) are -0.0240 and -0.0244, respectively, both significant at the 1% level. This demonstrates that over time, households participating in social security are significantly less likely to experience educational poverty.

Table 4: Overall Assessment of the Poverty Reduction Effect of Social Security

Variable	Educational Poverty		Health Poverty		Living Standard Poverty	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
TIME xSS	-0.0240***	-0.0244***	-0.1153***	-0.1177***	-0.0831***	-0.0788***
	(0.0086)	(0.0087)	(0.0303)	(0.0301)	(0.0255)	(0.0259)
TIME	0.0173**	0.0202***	0.2495***	0.2381***	-0.2587***	-0.2725***
	(0.0071)	(0.0070)	(0.0199)	(0.0205)	(0.0188)	(0.0198)
INC		-0.0081		0.0164		0.0381
		(0.0087)		(0.0274)		(0.0260)
LAB		-0.0031		-0.0269*		-0.0191
		(0.0050)		(0.0153)		(0.0157)
AGE		0.0006**		0.0039***		0.0008
		(0.0003)		(0.0007)		(0.0007)
GEN		-0.0016		-0.0112		-0.0145
		(0.0059)		(0.0176)		(0.0178)
MAR		-0.0035		-0.0700***		-0.0280
		(0.0095)		(0.0266)		(0.0269)
DIS		0.0042		0.0153		0.0217
		(0.0054)		(0.0166)		(0.0177)
GEOC		0.0000		0.0003***		0.0003**
		(0.0000)		(0.0001)		(0.0001)
TRANSC		-0.0000		0.0000		0.0000***
		(0.0000)		(0.0000)		(0.0000)
_cons	0.0208***	0.0576***	0.2376***	-0.0352	0.5470***	0.4987***
	(0.0029)	(0.0165)	(0.0083)	(0.0458)	(0.0093)	(0.0481)
pid	yes	yes	Yes	yes	Yes	Yes

Note: Standard errors in parentheses* p < 0.1, ** p < 0.05, *** p < 0.01

The coefficients for the standalone time variable (TIME) in Models 1 and 2 are 0.0173 and 0.0202, respectively, significant at the 5% or 1% level, suggesting that while educational poverty may naturally increase over time, social security participation effectively mitigates this upward trend. The results further indicate that social security participation significantly reduces health poverty among rural households. In Models 3 and 4, the coefficients for the interaction term between time and social security (TIME × SS) are -0.1153 and -0.1177, respectively, both significant at the 1% level. This demonstrates that households participating in social security are substantially less likely to experience health poverty over time. The coefficients for the time variable alone (TIME) in Models 3 and 4 are 0.2495 and 0.2381, respectively, also significant at the 1% level, suggesting that the incidence of health poverty tends to increase over time; however, social security participation effectively counteracts this upward trend. Similarly, social security contributes to alleviating living standard poverty in rural households. In Models 5 and 6, the coefficients for the TIME × SS interaction term are -0.0831 and -0.0788, respectively, significant at the 1% level, indicating that participation in social security significantly reduces the likelihood of living standard poverty. The coefficients for the TIME variable alone in Models 5 and 6 are -0.2587 and -0.2725, respectively, significant at the 1% level, showing that living standard poverty has generally declined over time, and social security participation further accelerates this reduction.

4.3 Additional Analyses

The PSM-DID method may not fully eliminate estimation biases arising from temporal heterogeneity. To enhance the reliability of the findings, a robustness test is conducted in this study. The approach involves using cross-sectional data from different years to construct panel data, thereby examining the poverty reduction effects of social security on rural households' educational poverty, health poverty, and living standard poverty.

Table 5: Robustness Test Result

Variable	Educational Poverty		Health Poverty		Living Standard Poverty	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
TIME x SS	-0.0260***	-0.0271***	-0.0867***	-0.0758***	-0.0740***	-0.0697***
	(0.0057)	(0.0056)	(0.0231)	(0.0228)	(0.0222)	(0.0221)
TIME	0.0105*	0.0121**	0.3032***	0.2761***	-0.0921***	-0.1273***
	(0.0055)	(0.0054)	(0.0160)	(0.0179)	(0.0164)	(0.0180)
INC		0.0044		0.0411**		0.0618***
		(0.0067)		(0.0206)		(0.0205)
LAB		0.0015		-0.0014		0.0349**
		(0.0044)		(0.0143)		(0.0149)
AGE		-0.0007***		0.0047***		0.0016**
		(0.0002)		(0.0006)		(0.0007)
GEN		0.0042		0.0078		-0.0007
		(0.0047)		(0.0158)		(0.0164)
MAR		-0.0119		0.0856***		-0.0651***
		(0.0086)		(0.0237)		(0.0250)
DIS		0.0043		-0.0179		0.0262
		(0.0051)		(0.0151)		(0.0161)
GEOC		0.0000		-0.0001		0.0002**
		(0.0000)		(0.0001)		(0.0001)
TRANSC		-0.0000		0.0000*		0.0000***
		(0.0000)		(0.0000)		(0.0000)
_cons	0.0211***	0.0609***	0.2401***	-0.0757*	0.5552***	0.4690***
	(0.0029)	(0.0138)	(0.0084)	(0.0418)	(0.0094)	(0.0455)
pid	yes	yes	yes	yes	Yes	Yes

Note: Standard errors in parentheses* p < 0.1, ** p < 0.05, *** p < 0.01

If social security continues to exhibit significant effects across these dimensions, the initial empirical results can be considered robust. For this

purpose, data from 2014 and 2020 were used to reconstruct the panel data for the robustness test. As shown in Table 5, the difference-in-difference coefficients remain significant across all six models, confirming the robustness of the empirical findings.

Table 6 examines the regional heterogeneity of social security effects on poverty across the Eastern, Central, and Western regions of China, focusing on educational poverty, health poverty, and living standard poverty. In the Eastern region, the interaction term for educational poverty shows a strong negative effect (b = -0.0461, p < 0.01), indicating that social security interventions have effectively alleviated educational poverty. In contrast, the interaction term is not significant in the Central region (b = -0.0202) or the Western region (b = -0.0020), suggesting that social security measures have had no significant impact on educational poverty in these areas. The effects on health poverty also vary by region. In the Eastern region, the effect is significant (b = -0.1078, p < 0.05), demonstrating that social security interventions have improved health conditions.

Table 6: Comparative Analysis of Social Security's Impact on Poverty in Eastern, Central, and Western Regions of China

Variable	Educational Poverty			Health Poverty			Living Standard Poverty		
	Eastern	Central	Western	Eastern	Central	Western	Eastern	Central	Western
TIME x SS	-0.0461***	-0.0202	-0.0020	-0.1078**	-0.0700	-0.1840***	-0.1446***	0.0233	-0.0611*
	(0.0163)	(0.0186)	(0.0096)	(0.0482)	(0.0586)	(0.0513)	(0.0449)	(0.0481)	(0.0347)
TIME	0.0445***	0.0189	-0.0094	0.2438***	0.1656***	0.3122***	-0.0011	-0.4187***	-0.4585***
	(0.0126)	(0.0136)	(0.0090)	(0.0324)	(0.0372)	(0.0379)	(0.0322)	(0.0327)	(0.0330)
INC	-0.0202	-0.0134	0.0130	0.0206	-0.0531	0.0551	0.0432	0.1096**	0.0228
	(0.0157)	(0.0145)	(0.0143)	(0.0464)	(0.0485)	(0.0476)	(0.0475)	(0.0428)	(0.0361)
LAB	-0.0086	-0.0008	0.0011	0.0501**	-0.0097	0.0397	-0.0236	0.0293	0.0462*
	(0.0081)	(0.0094)	(0.0090)	(0.0248)	(0.0282)	(0.0270)	(0.0260)	(0.0275)	(0.0261)
AGE	-0.0002	-0.0003	-0.0016***	0.0038***	0.0051***	0.0029**	0.0002	0.0020	0.0000
	(0.0004)	(0.0004)	(0.0005)	(0.0011)	(0.0012)	(0.0013)	(0.0011)	(0.0012)	(0.0013)
GEN	-0.0013	-0.0138	0.0114	0.0310	0.0042	-0.0148	0.0168	0.0302	-0.0480
	(0.0094)	(0.0128)	(0.0084)	(0.0264)	(0.0325)	(0.0344)	(0.0275)	(0.0306)	(0.0316)
MAR	0.0132	-0.0291	0.0007	0.0524	0.0573	0.1037**	-0.0460	0.0650	0.0202
	(0.0130)	(0.0236)	(0.0154)	(0.0424)	(0.0501)	(0.0476)	(0.0450)	(0.0479)	(0.0453)
DIS	-0.0095	0.0034	0.0154	0.0264	-0.0107	0.0415	0.1869***	-0.0857***	0.0467*
	(0.0080)	(0.0105)	(0.0098)	(0.0278)	(0.0307)	(0.0297)	(0.0279)	(0.0295)	(0.0278)
GEOC	0.0000	-0.0000	0.0000	-0.0001	-0.0002*	-0.0003**	0.0025***	0.0004***	-0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0001)	(0.0000)	(0.0000)	(0.0000)
TRANSC	-0.0000*	-0.0000	-0.0000	-0.0000	-0.0000	0.0000	-0.0000	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
_cons	0.0238**	0.0752***	0.0850***	-0.0848	-0.0097	0.0085	0.3629***	0.5721***	0.5265***
	(0.0262)	(0.0296)	(0.0316)	(0.0726)	(0.0847)	(0.0825)	(0.0794)	(0.0851)	(0.0791)
pid	yes	yes	yes	yes	yes	yes	yes	yes	yes

Note: Standard errors in parentheses* p < 0.1, ** p < 0.05, *** p < 0.01

In the Central region, the negative effect (b = -0.0700) is not statistically significant, indicating a limited role of social security in reducing health poverty. Conversely, in the Western region, the effect is strongly negative and significant (b = -0.1840, p < 0.01), highlighting a substantial contribution of social security to health poverty alleviation. Regarding living standard poverty, the Eastern region exhibits a highly significant negative effect (b = -0.1446, p < 0.01), confirming the effectiveness of social security interventions in improving living standards. In the Central region, the effect is positive but not significant (b = 0.0233), suggesting that social security has not effectively addressed living standard poverty. In the Western region, the effect is significantly negative (b = -0.0611, p < 0.05), indicating that social security participation has contributed to a reduction in living standard poverty. Overall, these results illustrate that the impact of social security on multidimensional poverty differs substantially across regions, with the Eastern and Western regions benefiting more than the Central region.

5. Conclusion

Using CFPS panel data from 2010 and 2020, this study employs the PSM-DID method to examine the impact of social security on educational, health, and living standard poverty among rural households. The findings indicate that social security effectively reduces educational poverty, acting as a buffer for less-educated individuals who are at higher risk of poverty. It also alleviates health poverty, particularly for older adults facing chronic conditions, with married or partnered individuals benefiting from economic cooperation, emotional support, and healthier behaviours. Stable labour force participation further supports healthcare access and reduces health-related poverty. Social security additionally improves living standards by mitigating housing-related poverty and reducing geographically driven disparities, especially in remote areas. Regional analysis reveals that the Eastern region experiences significant declines in educational and health poverty, the Central region shows limited impact, and the Western region benefits in terms of health and living standard poverty. These findings emphasise the need for region-specific social security policies. Overall, social security substantially reduces rural multidimensional poverty by enhancing education, health, and living conditions through its comprehensive protective mechanisms.

6. References

[1] Gao Q, Yang S, & Li S. Welfare, targeting, and anti-poverty effectiveness: The case of urban China. Quarterly Review of Economics and Finance. 2015. Doi: https://doi.org/10.1016/j.qref.2014.06.005

[2] Flora P, & Heidenheimer AJ. The development of welfare states in Europe and America: Transaction Publishers; 1981. https://library.wur.nl/WebQuery/titel/235440

[3] Zhao Q, Brosig S, Luo R, Zhang L, Yue A, & Rozelle S. The new rural social pension program in rural China: participation and its correlates. China Agricultural Economic Review. 2016. Doi: https://doi.org/10.1108/CAER-07-2016-0116

[4] Zhou M, Sun X, & Huang L. Does social pension expansion relieve depression and decrease medical costs? Evidence from the rural elderly in China. International Journal of Public Health. 2022. Doi: https://doi.org/10.3389/ijph.2022.1604296

[5] Zheng H, & Zhong T. The impacts of social pension on rural household expenditure: Evidence from China. Journal of Economic Policy Reform. 2016. Doi: https://doi.org/10.1080/17487870.2015.1041524

[6] Chen Z, Bengtsson T, & Helgertz J. Labor supply responses to New Rural Social Pension Insurance in China. 2015.Retrieved from: https://hdl.handle.net/10419/124888

[7] Barrientos A, & Hulme D. Social protection for the poor and poorest: Concepts, policies and politics: Springer; 2016. https://doi.org/10.1057/978-0-230-58309-2

[8] Holzmann R, & Jørgensen S. Social risk management: A new conceptual framework for social protection and beyond. International Tax and Public Finance. 2000. Doi: https://doi.org/10.1023/A:1011247814590

[9] Alkire S, & Foster J. Counting and multidimensional poverty measurement. Journal of Public Economics. 2011. Doi: https://doi.org/10.1016/j.jpubeco.2010.11.006

[10] Thorbecke E. Multidimensional poverty: conceptual and measurement issues. 2015. https://doi.org/10.1057/9780230592407_1

[11] Cai Y, & Cheng Y. Pension reform in China: Challenges and opportunities. 2015. https://doi.org/10.1002/9781118982433.ch4

[12] Liu Y, Rao K, & Hsiao WC. Medical expenditure and rural impoverishment in China. 2003. https://www.jstor.org/stable/23499219

[13] Ringen S, & Ngok K. What kind of welfare state is emerging in China? 2017. https://doi.org/10.1057/978-1-137-53377-7_8

[14] Hannum E, Liu J, & Frongillo EA. Poverty, food insecurity and nutritional deprivation in rural China. 2014. https://doi.org/10.1016/j.ijedudev.2012.07.003
[15] Chi XX, Liu XH, & Zhang ZZ. Measuring multidimensional health poverty in China. Frontiers in Public Health. 2022. Doi: https://doi.org/10.3389/fpubh.2021.786325
[16] Wang H, Yip W, Zhang L, & Hsiao WC. The impact of rural mutual health care on health status: evaluation of a social experiment in rural China. Health Economics. 2009. https://doi.org/10.1002/hec.1465
[17] Yu J. Multidimensional poverty in China: Findings based on the CHNS. Social Indicators Research. 2013. Doi: https://doi.org/10.1007/s11205-013-0250-x
[18] Dai L, & Guo Y. The problem and countermeasures of the failure of the rural social security system to reduce poverty. Discover Sustainability. 2024. Doi: https://doi.org/10.1007/s43621-024-00244-z
[19] Zheng Q, Lei M, Zhao J, Jiang X, & Liu H. The Well-Being of Rural Elderly Surrounding Chinese Megacities: A Case Study of Xi'an, Shaanxi. Sustainability. 2025. Doi: https://doi.org/10.3390/su17020530
[20] Liu Z, & Liu W. Spatial-temporal relationship between water resources and economic development in rural China. International Journal of Environmental Research and Public Health. 2021. Doi: https://doi.org/10.3390/ijerph18041540
[21] Dong F, Yu B, Hua Y, Zhang S, & Wang Y. A comparative analysis of residential energy consumption in urban and rural China. International Journal of Environmental Research and Public Health. 2018. Doi: https://doi.org/10.3390/ijerph15112507
[22] Xie X, & Xue W, editors. Energy usage, problems and policy proposals: evidence from distinctive villages in poverty-stricken loess areas2018. http://doi.org/10.1088/1755-1315/121/5/052097
[23] Li S, Li C, Hasan MM, Moudud-Ul-Huq S, & Iram R. Evaluating the role of education and human capital in poverty reduction. The Singapore Economic Review. 2023. Doi: https://doi.org/10.1142/S0217590821440069
[24] He Y, & Ahmed T. Farmers' livelihood capital and its impact on sustainable livelihood strategies. Sustainability. 2022. Doi: https://doi.org/10.3390/su14094955
[25] Zeng W, Zhao P, Zhao Y, & Saddique R. The multidimensional relative poverty of rural older adults in China and the effect of the health poverty alleviation policy. Frontiers in Public Health. 2022. Doi: https://doi.org/10.3389/fpubh.2022.793673
[26] Leibbrandt M, & Woolard I. Household incomes, poverty and inequality in a multivariate framework. 1999.Retrieved from: http://hdl.handle.net/11427/7239
[27] Yue C, & Liu Y. Impact of education on the income of different social groups. Frontiers of Education in China. 2007. Doi: https://doi.org/10.1007/s11516-007-0016-9
[28] Fu T. Family Backgrounds, Rates of Returns to Education and Income Gap. 2016. https://cir.nii.ac.jp/crid/1050564289088712064
[29] Dercon S, & Hoddinott J. Health, shocks and poverty persistence. 2004. https://ideas.repec.org/p/unu/wpaper/dp2003-08.html
[30] Parsell C, & Marston G. Beyond the 'at risk' individual: Housing and the eradication of poverty to prevent homelessness. Australian Journal of Public Administration. 2012. Doi: https://doi.org/10.1111/j.1467-8500.2012.00758.x