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The poverty alleviation effect of transfer payments: evidence from China

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Transfer payments play a crucial role in combating poverty in countries. However, the effectiveness of transfer payments in alleviating poverty remains controversial due to variations in environmental factors, economic development, and cultural contexts across different nations. In this study, we employ counterfactual causal inference to examine the influence of government transfer payments on poverty. By utilizing data from China, we present new evidence that sheds light on related issues. Our findings reveal that transfer payments have a negative impact on the overall income of rural poor households. This can be attributed to a decrease in labor supply among rural poor residents who receive such payments, resulting in reduced wage income. Additionally, transfer payments lead to decreased expenditure on food and increased spending on healthcare. These changes in total income and consumption patterns indicate that China's current transfer payment policy has short-term efficacy by meeting the basic living security needs of rural poor residents and improving their health conditions. However, the lack of significant changes in education spending suggests that transfer payments have little long-term effect.

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Introduction

Poverty has long been a formidable obstacle hindering rapid economic progress worldwide. Particularly for low-income rural residents, poverty poses challenges in fulfilling fundamental necessities such as water, housing, and transportation. Reducing poverty is essential for enhancing residents' well-being and health outcomes. Consequently, "no poverty" has become a primary objective within sustainable development goals (Nugroho et al., 2021; Bolch et al., 2022). Many economists believe that economic growth can end poverty through monetary redistribution, expanding employment, and financial inclusion (Montgomery & Weiss, 2011; Bolch et al., 2022; Bhagwati & Panagariya, 2012). Despite significant advancements in productivity, economic development, and global wealth growth over the past three decades, there has been a substantial widening of the economic disparity between the affluent and the impoverished. On one hand, we witness the rapid expansion of the world economy; on the other hand, numerous individuals remain trapped in poverty with no means to escape. While economic growth is crucial for alleviating poverty, it alone cannot eradicate this issue entirely. The implementation of various macro-control policies holds great importance in achieving poverty eradication goals (Cabrera et al., 2015; Siburian, 2022; Dao & Edenhofer, 2018). In 2012, China initiated its poverty alleviation plan results. According to the data released by the World Bank (East Asia and Pacific Economic Update, 2020 & 2021), the number of poor people (US$5.50/day 2011 PPP) in China fell from 223.8 million in 2019 to 186 million in 2021. Furthermore, when considering low- and middle-income countries' standards (US$3.20/day 2011 PPP), Official statistics indicate that from 2016 to 2019 alone, approximately fifty million people were lifted out of poverty in China while all ninety-eight point ninety-nine million rural poor were successfully elevated above this threshold year-end of 2020. Overall, China's policies have demonstrated a significant impact on levels.

Poverty reduction plans worldwide primarily focus on augmenting residents' income levels and improving their livelihoods enhanced employment opportunities and better healthcare provisions. Fiscal policy plays a pivotal role as an instrument employed by governments to combat poverty effectively; however, several programs have failed to achieve their intended objectives (Yalegama et al., 2016). A precise definition of suitable fiscal expenditure and deficit scale for poverty eradication remains elusive. Evaluating the impact on low-income individuals constitutes a crucial element in any poverty reduction. Such assessment plays a pivotal role in ensuring the long-term sustainability of poverty alleviation policies and optimizing resource allocation (Ames et al., 2001). Rural areas are the focus of poverty alleviation strategies, and the reduction of rural poor population is of great significance to poverty eradication in developing countries. Fiscal transfer is the main means of alleviating rural impoverishment in China[1]. In an extended duration, four extensive transfer payment systems have been implemented: New rural endowment insurance system, Rural minimum living security system, New rural cooperation medical system, and Agricultural subsidy system (Table 1).

This paper examines the impact of government transfer payments on poverty alleviation among aiming to address the following questions: Can government transfer payments effectively eradicate rural poverty? Does China's transfer payment policy for poverty alleviation have any adverse effects? Have transfer payments improved living conditions for impoverished rural families?

The rest of this article is organized as follows. Section "Theoretical analysis and hypotheses" presents theoretical analysis and research hypotheses. Section "Research design" includes empirical design. Sections "Empirical results and discussion" presents the detailed empirical results. Section "Conclusion and policy recommendation" summarizes the conclusion and policy recommendation.

Theoretical analysis and hypotheses

Increasing attention has been devoted to poverty alleviation payments; however, controversy remains regarding the impact of transfer payments (Bastagli et al., 2016). Van den Berg & Cuong (2011) argue that transfer payments augment non-labor income, leading to a decline in labor supply by elevating the shadow price of household labor. The presence of offsetting effects may result in residents' being lower than before receiving transfer payments (Clark & Lee, 2008; Habimana et al., 2021). Long-term subsidies provided to low-income individuals have fostered dependence on welfare and perpetuated poverty, with rural residents even more severe challenges (Song & Xie, 2020). Numerous studies present divergent perspectives. Transfer payments can enhance residents' healthcare conditions, boost their overall income, and improve access to education for poverty alleviation purposes. Qin et al. (2021) contend that transfer payments reduce the likelihood of households (especially low-income rural households) falling into poverty due to illness. In this process, enhanced labor efficiency among rural residents has led to increased income levels (Shmueli et al., 2008; Aryeetey et al., 2016; Fang & Zhou, 2020). Education plays a pivotal role in efforts aimed at reducing poverty (Hofmarcher, 2021; Campillo, García, 2022). Impoverished rural residents encounter difficulties in accessing education. Chiapa et al. (2012) and Gutiérrez et al. (2019) found that transfer payments assist poor households in enhancing their human capital through education which ultimately leads to higher future incomes. The main causes of rural family poverty in China are motivation and major illnesses affecting family[2]. It is evident that there is no unified conclusion regarding the effect of transfer payments on alleviating rural amount groups for policy-related transfers vary across countries. (Banerjee et al., 2017). China currently relies mainly on transfer payments to alleviate rural poverty, but the effectiveness of this approach remains unclear.

Table 1 Description of the relevant policy.

System name	Start time	Policy goals	Policy focus
New rural endowment insurance system	2009	Ensure the basic life of rural residents in old age	Living standards of rural residents
Rural minimum living security system	2007	Ensure the basic livelihood of the rural poor who are unable to maintain a minimum living income	Living standards of rural poor residents
New rural cooperation medical system	2003	Provide a full range of medical services for farmers	Medical care for rural residents
Agricultural subsidy system	2004	Government investment in the agricultural sector and subsidies for prices, exports of agricultural products	Rural development

Building upon the aforementioned analysis, we propose our first research hypothesis.

Hypothesis 1. Transfer payments contribute to an increase in income among rural residents in China.

Income serves as a crucial criterion for determining poverty levels among individuals. While transfer payments may provide targeted assistance through cash or reimbursement, it does not necessarily result in a direct increase in residents' income; however, it does have a certain impact on poverty alleviation. Liu et al. (2023) argue that relying solely on a single dimension such as income to measure poverty is biased and suggest that resident consumption expenditure can more accurately reflect changes in living conditions, enabling a comprehensive assessment of policy effects. Short et al. (1998) contend that consumption is a superior metric to income when evaluating the welfare and poverty impacts of it more realistically reflects residents' living conditions. Few studies have examined how transfer payments affect the consumption patterns of impoverished rural households (Handa et al., 2018). Existing predominantly analyzes the influence of transfer payments on household consumption from a macro perspective (Romer & Romer, 2016; Kim, 2021). However, analyzing changes in residents' consumption from a micro perspective is essential for evaluating the effectiveness of transfer payments and understanding the causes and current state of rural poverty in China. One contribution made by this article lies in providing a more comprehensive assessment of how transfer payments impact different types of income and consumption among residents. When impoverished families residing in rural areas receive transfer payments, their primary focus initially lies on meeting basic before considering developmental expenditures (Yin & Guo, 2021). If residents prioritize increasing it as a primary measure against rural poverty in China due to disease prevalence, it becomes crucial to consider out-of-pocket medical costs as an indicator of healthcare expenditure within this study. Building upon this premise, we present the following hypothesis.

Hypothesis 2. Transfer payments enhance total consumption expenditure and elevate living standards among rural residents.

Research design

Econometric model setting. Traditional models typically employ Ordinary Least Squares (OLS) methods for estimation. However, this approach is susceptible to two biases.:

1. The model may encounter issues related to missing variables despite accounting for heterogeneity among rural households.
2. The endogeneity of variables may result in sample self-selection bias.

To address this issue, we employ the propensity score matching (PSM) approach to mitigate systematic bias and sample self-selection caused by the correlation between household status, living environment, productive employment of rural households, and receipt of public transfers. We divide our sample into two categories: (1) Rural households that receive transfer payments; and (2) Rural households that do not receive transfer payments. Since both groups can be explained by common factors, we use these factors for hierarchical pairing. Finally, we weigh the hierarchical differences and the proportion of stratification to obtain the average treatment effect on the treated group (ATE):

$$\ln y = \alpha + \beta p + \gamma x + u, E(\mu) = 0 \tag{1}$$

$\ln y$ is the outcome variable; β is the coefficient to be estimated, denoting the effect of transfer payments on the various income and expenditures of the rural household; p is a binary variable, taking on the value of one for the households that received

transfers (treatment group) and zero otherwise (control group); x is a matrix of covariates containing other explanatory variables; α is a constant and μ is the random error term with expectation 0.

We use the probit method to estimate the propensity score (probability) of each sample household to receive transfers.

$$P(X_i) = \Pr\{exp_i = 1 | X_i\} \tag{2}$$

We estimate the propensity score of each rural household $P(X_i)$ under the condition of independence. According to the common support domain of propensity score, the treatment group and the control group are matched. After matching according to the propensity score $P(X_i)$, the average treatment effect (ATT) of rural households receiving transfer payments is:

$$\tau_{\text{ATT}} = \text{E}(Y_1 | p = 1) - \text{E}(Y_0 | p = 1) \tag{3}$$

Y_1 represents the value of the explained variable when the sample households are treated. Y_0 represents the value of the explained variable when the sample households are not treated. Since the latter cannot be directly observed, $\text{E}(Y_0 | p = 1)$ is a counterfactual effect to be estimated.

Variables and data sources. Our two datasets are derived from the China Labor-force Dynamic Survey. We use China Labor-force Dynamic Survey data (CLDS 2016) for empirical analysis. And we conduct corresponding analyses using the updated dataset (CLDS 2018)[3]. The data of CLDS 2016 reflects the current situation and historical changes in China's labor force. The labor force aged 15 to 64 is the main object of the survey. For this data, we only retained the data about rural households. The data handling process is as follows: (1) Matching income[4], consumption, and resident information by the ID of the head of households in the questionnaire. We obtain variables that reflect the basic characteristics of the household (such as age, family size, education, etc.); (2) Based on the question of "Accept unemployment benefits or not/Accept social assistance funds or not/Accept basic living allowances or not" set in the survey questionnaire as the basis for classification. Households receiving transfers are defined as the treated group while others are defined as the control group; (3) Screening variables representing, employment, and assets including factors like productive electricity usage by residents, car ownership status, internet usage frequency, etc. Only rural households were considered for analysis using a final sample size of 4525 households. The selected covariates control the characteristics of household assets, production, employment, and living conditions of the sample, including important factors that affect farmers' income, consumption, and wealth level, as well as controlling for the characteristics of farmers' living conditions. Table 2 presents definitions and descriptive statistics of variables used in this study.

The essence of Table 2 is to provide evidence highlighting differences between two groups necessitating matching these characteristics ensuring observations are similar before comparing outcomes using the propensity score matching method. Furthermore, the CLDS 2018 dataset serves similar objectives as CLDS 2016 but represents an updated version encompassing a broader scope capturing changes and developments within China's labor market comprehensively. The same set of variables were selected from both datasets with Table A1 in the appendix presenting definitions and descriptive statistics.

Empirical results and discussion

Model testing. To ensure the accuracy of our findings, we employ matching and standard support hypothesis testing for the balance test. Table 3 presents the results of the matching balance test conducted on the model. The results indicate that all the covariates fit the selection after matching the treatment and control groups.

Table 2 Definition of variables and descriptive statistics (CLDS 2016).

	Variables	Definition	Mean (all sample, $n = 4525$)	Mean (treatment group, $n = 553$)	Mean (control group, $n = 3972$)
Covariates	Age	The age of the household head	50.395	53.770	49.924
	Marriage	Marital status of household head (1 = married, 0 = unmarried)	0.888	0.810	0.899
	Educ	The highest educational attainment of household head (1 = high school or above, 0 = below high school)	0.119	0.065	0.126
	F_size	Number of family members	1.953	1.891	1.962
	Tap_water	Tap-water accessed at home (1 = yes, 0 = no)	0.575	0.529	0.581
	Unpol	The drinking water source is not contaminated (1 = yes, 0 = no)	0.198	0.151	0.205
	Natgas	Natural gas accessed at home (1 = yes, 0 = no)	0.446	0.274	0.470
	Intter	Frequent power interruptions (1 = yes, 0 = no)	0.045	0.068	0.041
	P_elec	Productive electricity accessed at home (1 = yes, 0 = no)	0.027	0.016	0.028
	Internet	Internet accessed at home (1 = yes, 0 = no)	0.478	0.298	0.503
	Phone	Phone accessed at home (1 = yes, 0 = no)	0.977	0.951	0.980
	Car	The household own a car (1 = yes, 0 = no)	0.156	0.056	0.170
	Tractors	The household own a tractor (1 = yes, 0 = no)	0.158	0.130	0.162
	Implements	The household own large-scale agricultural implements (1 = yes, 0 = no)	0.024	0.019	0.025
	Livestock	The household own livestock for production (1 = yes, 0 = no)	0.094	0.153	0.086
	Debt	The household is in debt (1 = yes, 0 = no)	0.355	0.394	0.349
	A_cost	Cost of the farm	10,137.250	5359.382	10,867.181
	A_sub	Access to agricultural subsidies (1 = yes, 0 = no)	0.587	0.606	0.584
Outcome variables describing income	In	Total income	41,416.001	23,516.970	43,907.980
	In1	Gross income from agriculture, forestry, animal husbandry and fishery	10,764.610	9033.329	11,005.650
	In2	Wage income	22,032.201	11,067.490	23,558.751
	In3	Operating income	6060.593	2435.796	6565.254
	In4	Property income	837.303	832.049	875.038
Outcome variables describing consumption	Ex	Total consumption expenditure	40,068.981	29,459.514	41,546.082
	Ex1	Food expenditure	13,439.660	8715.425	14,097.391
	Ex2	Healthcare expenditure	7420.901	7296.743	8312.684
	Ex3	Education expenditure	5387.525	4637.653	5491.925
Treatment variable	Treat	Accept transfer payments or not (1 = yes, 0 = no)			

Note: Income and consumption variables in the table are measured in CNY (Same below), and the exchange rate between USD and CNY for that year was 6.7.

The percentage bias between these groups is minimal, ranging from 0.1% to 3.7%. Consequently, no selection bias exists in the model.

Figure 1 illustrates the graphical balance diagnostic test performed on our model, revealing a standardized percentage bias of zero across covariates. This confirms that the parallel trend hypothesis holds true. It is important to note that if there are insufficient overlap and control groups, effective matching cannot be achieved for samples outside this overlapping area, leading to excessive sample loss which may compromise result reliability. Figure 2 provides a comparison of propensity scores between both groups, demonstrating a sufficiently similar density distribution among matched treatment and control subjects with only a minimal proportion falling outside the common support domain. Therefore, the common support hypothesis is satisfied.

The aforementioned findings are derived from the CLDS 2016 dataset. As was mentioned in the *Variables and data sources*, we used the updated data (CLDS 2018) for comparative analysis and robustness testing. Following the same methodology as above, we conducted an identical process using the CLDS 2018 dataset. Notably, all various hypotheses remain satisfied, and a comprehensive presentation of figures and tables illustrating these results can be found in the appendix.

Empirical results. We employ the nearest propensity scores between the treatment and control groups, aiming to identify disparities in income and across both groups[5]. present the estimation results of propensity score matching using CLDS 2016 data, specifically examining the impact of transfer payments on

Table 3 Matching balance test on the model.

Covariate	Treatment group	Control group	%bias	t-test	p > t
Age					
U	54.062	51.531	20.8	4.02	0.000***
M	53.961	53.758	1.7	0.23	0.817
Marriage					
U	0.815	0.913	−28.8	−6.03	0.000***
M	0.819	0.826	−1.9	−0.24	0.812
Educ					
U	0.061	0.106	−16.3	−2.75	0.006***
M	0.061	0.065	−1.4	−0.21	0.831
F_size					
U	1.964	2.003	−4.2	−0.79	0.432
M	1.969	1.967	0.2	0.03	0.977
Tap_water					
U	0.520	0.543	−4.6	−0.84	0.401
M	0.518	0.524	−1.3	−0.18	0.858
Unpol					
U	0.146	0.193	−12.5	−2.22	0.027**
M	0.146	0.149	−0.7	−0.10	0.922
Natgas					
U	0.220	0.401	−39.9	−6.93	0.000***
M	0.221	0.238	−3.7	−0.56	0.577
Intter					
U	0.058	0.044	6.5	1.25	0.211
M	0.059	0.059	−0.1	−0.01	0.992
P_elec					
U	0.017	0.029	−7.5	−1.28	0.202
M	0.018	0.019	−0.7	−0.11	0.913
Internet					
U	0.294	0.451	−32.7	−5.84	0.000***
M	0.296	0.312	−3.5	−0.50	0.616
Phone					
U	0.953	0.988	−20.6	−5.02	0.000***
M	0.958	0.958	0.1	0.02	0.988
Car					
U	0.061	0.143	−27.3	−4.47	0.000***
M	0.061	0.067	−1.8	−0.31	0.757
Tractors					
U	0.153	0.222	−17.6	−3.09	0.002***
M	0.154	0.161	−1.7	−0.26	0.798
Implements					
U	0.023	0.034	−6.6	−1.14	0.255
M	0.023	0.024	−0.5	−0.08	0.940
Livestock					
U	0.179	0.106	20.9	4.20	0.000***
M	0.180	0.170	2.8	0.36	0.717
Debt					
U	0.405	0.374	6.3	1.16	0.245
M	0.407	0.400	1.5	0.20	0.840
A_cost					
U	5335.5	10843	−16.2	−2.33	0.020***
M	5357.4	5578.3	−0.6	−0.24	0.812
A_sub					
U	0.607	0.585	4.5	0.83	0.409
M	0.605	0.606	−0.1	−0.01	0.922

Note: Sample 4525; **Significant at the 5% level. ***Significant at the 1% level.

Fig. 1 Graphical balance diagnostic test. Figure 1 shows the balance diagnosis test of our model using CLDS 2016 data, indicating that the parallel trend hypothesis holds true.

Fig. 2 Comparison of propensity score between treatment group and control group. Figure 2 shows the comparison of propensity scores between the treatment group and control group of our model using CLDS 2016 data, indicating that the common support hypothesis holds true.

decomposing various sources of income. Table 4 demonstrates that income, there is no significant reduction in other types of income. We hypothesize that recipients of transfer payments among the rural poor may have reduced their labor supply leading to a decline in wage earnings. Does this imply a failure in China's current transfer payment policy for poverty alleviation? Assessing poverty solely based on income no longer provides a comprehensive or accurate reflection of rural poverty dynamics in China (Wang et al., 2022). Therefore, deeper analysis is warranted to derive unbiased conclusions.

Table 5 demonstrates that transfer payments have a negative impact on food expenditure while positively influencing healthcare expenditure. The reduction in food expenditure consequently leads to a decline in residents' overall consumption expenditure. Notably, the essential expense of food has significantly decreased without an accompanying increase in income, indicating that the government has provided poverty alleviation assistance through non-monetary means. Although cash income decreased, the basic living security of poor households has been met through other forms[6]. Simultaneously, the rise in healthcare expenditure highlights the primary need for medical treatment among poor rural households once their basic living security is guaranteed. China's

income and consumption expenditure among rural poor households independently.

Table 4 reveals a surprising finding that total income for rural poor households actually decreases after transfer payments, challenging conventional expectations regarding poverty alleviation through such transfers. This unexpected outcome aligns with previous scholarly perspectives (Liu, 2008; Song & Xie, 2020). To shed light on this phenomenon, we conduct an analysis of
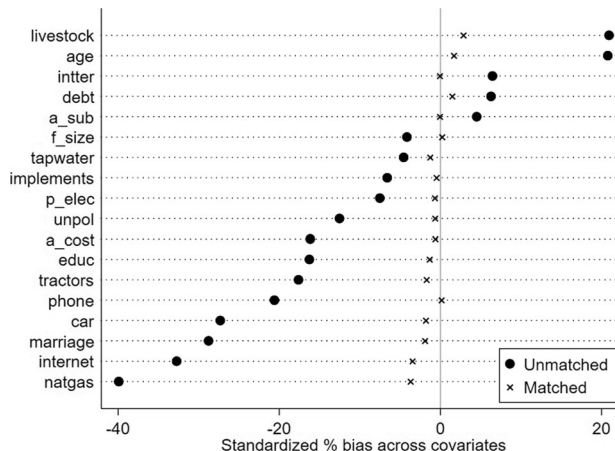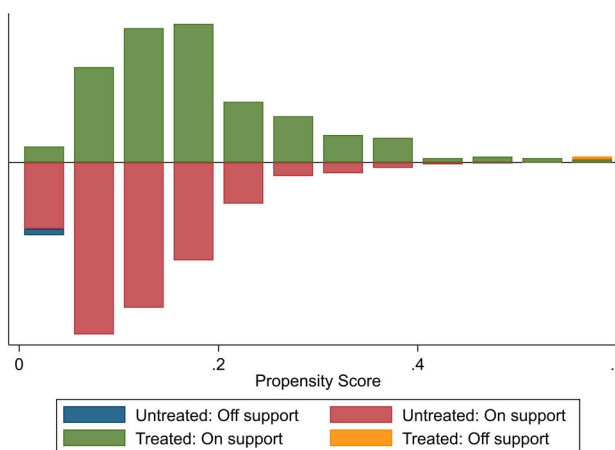
Table 4 The results from the PSM exercise on the income.

Variables and definitions	Mean (treatment group)	Mean (control group)	Average treatment effect on the treated (ATT)	Standard error
ln (Total income)	22,077.482	30,148.984	−8071.502***	1789.075
ln1 (Gross income from agriculture, forestry, animal husbandry, and fishery)	10,622.897	11,838.422	−1215.525	1163.302
ln2 (Wage income)	9884.477	14,537.808	−4653.331***	1361.371
ln3 (Operating income)	1144.327	2037.156	−892.829	617.890
ln4 (Property income)	348.451	264.971	83.480	297.217

Note: ***Significant at the 1% level.

Table 5 The results from the PSM exercise on the consumption expenditure.

Variables and definitions	Mean (treatment group)	Mean (control group)	Average treatment effect on the treated (ATT)	Standard error
Ex (Total consumption expenditure)	28,509.407	34,180.216	−5670.809	3562.517
Ex1(Food expenditure)	7689.619	9990.280	−2300.661***	832.702
Ex2 (Healthcare expenditure)	7793.335	6506.953	1286.382*	699.204
Ex3 (Education expenditure)	4548.521	4178.411	370.110	671.043

Note: *Significant at the 10% level. ***Significant at the 1% level.

Table 6 The results from the PSM exercise on the income (CLDS 2018).

Variables and definitions	Mean (treatment group)	Mean (control group)	Average treatment effect on the treated (ATT)	Standard error
ln (Total income)	21,184.830	33,292.878	−12,108.048***	2430.237
ln1(Gross income from agriculture, forestry, animal husbandry and fishery)	9885.886	12318.804	−2432.918	1477.286
ln2 (Wage income)	8546.201	16,331.966	−7785.765***	1715.237
ln3(Operating income)	975.000	2364.632	−1389.632	1248.588
ln4(Property income)	28.788	373.422	−344.634	265.30971

Note: ***Significant at the 1% level.

Table 7 The results from the PSM exercise on the consumption expenditure (CLDS 2018).

Variables and definitions	Mean (treatment group)	Mean (control group)	Average treatment effect on the treated (ATT)	Standard error
Ex (Total consumption expenditure)	33,079.383	32,605.014	474.368	3854.251
Ex1 (Food expenditure)	5177.273	7645.616	−2468.343***	493.936
Ex2 (Healthcare expenditure)	8039.280	6866.002	1173.278	2123.477
Ex3 (Education expenditure)	3717.917	4500.425	−782.508	533.834

Note: ***Significant at the 1% level.

poverty alleviation campaign primarily focuses on enhancing rural medical institutions and expanding access to medical opportunities while providing reimbursement for medical insurance[7]. The changes observed in expenditures demonstrate how transfer payments can effectively assist impoverished rural residents in escaping poverty, particularly addressing issues arising from illness.

Consequently, it can be transfer payments do not contribute to an increase in the income of rural residents in China, thereby invalidating hypothesis 1. However, from the perspective of consumption expenditure (Hypothesis 2), transfer payments enhance the living conditions of impoverished rural residents and alleviate poverty by enabling them to allocate more expenses instead of necessary food expenditures. This approach addresses

the issue of diseases, which serves as a primary factor contributing to rural poverty in China (as mentioned in footnote 1).

Further analysis. To conduct a comparative analysis and test the robustness of the aforementioned findings, we obtained results using CLDS 2018 data. Tables 6 and 7 present the estimation results for PSM analysis based on the CLDS 2018 data.

Table 6 reveals consistent impacts of transfer payments on income as observed in Table 4, in the decline of wage income suggests that as the transfer payment policy persists for poverty alleviation, its inhibitory effect on residents' labor supply continues to strengthen. In order to validate this conclusion, we employ the proportion of actively participating residents in labor

Table 8 The results from the PSM exercise on the Wage-labor ratio.				
Variables	Mean (treatment group)	Mean (control group)	Average treatment effect on the treated (ATT)	Standard error
Wage-labor ratio (CLDS 2016)	0. 381	0.461	−0.080***	0.027
Wage-labor ratio (CLDS 2018)	0.303	0.413	−0.110***	0.031
Note: ***Significant at the 1% level. Table 9.				

Table 9 The results from the PSM exercise on Engel's coefficient.				
Variables	Mean (treatment group)	Mean (control group)	Average treatment effect on the treated (ATT)	Standard error
Engel's Coefficient (CLDS 2016)	0.381	0.498	−0.117*	0.064
Engel's Coefficient (CLDS 2018)	0.271	0.364	−0.093***	0.038
Note: *Significant at the 10% level. ***Significant at the 1% level.				

as an outcome variable for further analysis. Wage-labor represents the percentage of employed rural impoverished residents who receive wages. Intuitively displayed in Table 8 is evidence supporting the inhibitory effect of transfer payments on residents' labor supply. Additionally, Table 7 reports a significant negative impact of transfer payments on food expenditure, consistent with findings from Table 5. Although health expenditure exhibits an increasing trend. We posit that past transfer payment policies have enabled access to medical services; evidenced by self-reported good health status increasing from 48.64% (CLDS 2016) to 56.37% (CLDS 2018). Lastly, Table 9 demonstrates how transfer payments negatively affect Engel's coefficient[8], indicating that poverty alleviation through such transfers primarily improves living conditions rather than solely relying on income augmentation.

We have observed a dearth of substantial growth in educational spending among impoverished rural residents, which presents a persistent obstacle to tackling the problem of poverty over time. Gaining access to higher education is vital for breaking free from impoverishment and attaining elevated income levels. A conditional cash transfer scheme can effectively tackle this challenge (Boca et al., 2021). Overall, China's ongoing efforts in transfer payments primarily accomplish preliminary goals like guaranteeing fundamental livelihood security for impoverished rural households and offering supplementary healthcare services. Nevertheless, realizing the prospective influence of bolstering education on reducing poverty currently.

To further examine the robustness of our findings, we employ the logarithm of transfer payments received by rural impoverished households for regression analysis. The control variables align with the covariates utilized in the previously mentioned PSM model. Table 10 presents the outcomes of our regression analysis, which reveal a significant reduction in total income and wage income, as well as food expenditure among rural poor households due to transfer payments. However, these payments exhibit a positive impact on healthcare expenditure, thereby corroborating the results obtained from our PSM estimates.

Conclusion and policy recommendation
The present study utilizes data from the CLDS (2016 & 2018) to examine the impact of transfer payment policies on the income and consumption patterns of impoverished rural residents in China. The ensuing findings are as follows:

1. After receiving transfer payments, the total income of rural poor households decreases. Transfer payments have failed to effectively alleviate rural poverty through increasing income due to reduced labor supply and resulting decrease in wage income among recipients.
2. Transfer payments reduce food expenditure and increase healthcare expenditure. The changes in total income and consumption structure indicate that transfer payments meet the basic living security of rural poor residents' and improve their health conditions. Transfer payments can effectively address diseases that is the main cause of poverty in rural China.
3. Transfer payments have no significant impact on education expenditure. Rural poor residents just maintain the status quo in education without further investment. Education has the long-term effect of avoiding poverty return and intergenerational transmission of poverty. The current transfer payment policy for poverty alleviation in China can only complete the first phase of providing basic living security for rural poor residents but may be insufficient for achieving long-term effects such as avoiding poverty return and intergenerational transmission.

China's successful eradication of overall and extreme poverty by the end of 2020 is widely acknowledged. As transfer payments serve as the primary policy tool for poverty alleviation in China, assessing their effectiveness provides valuable insights for policymaking in developing countries. This study holds relevance to rural poverty alleviation research and offers potential references for examining the merits and drawbacks of China's current transfer payment policy in this field.

When assessing the impact of policies on poverty alleviation crucial to consider indicators that accurately measure poverty. Relying solely on income as a criterion may introduce bias. Nevertheless, income remains an important gauge of residents' living standards and cannot be disregarded. The decline in total income can primarily be attributed to the negative influence of transfer payments supply, resulting in reduced wage income. Particular attention should be paid to this adverse effect. We suggest classifying rural poor residents based on their work capacity and

Table 10 The results of regression analysis.

Variables	In (total income)	In2 (wage income)	Ex1 (food expenditure)	Ex2 (healthcare expenditure)
Transfer payments	−0.043*** (0.007)	−0.107*** (0.034)	−0.046*** (0.008)	0.078*** (0.022)
Control variables	Yes	Yes	Yes	Yes
Constant	8.883*** (0.184)	2.722*** (0.845)	7.738*** (0.217)	3.363*** (0.629)
Observations	4525	4525	4525	4525
Adjusted R-squared	0.227	0.073	0.137	0.097

Notes: Robust standard error in parentheses. ***Significant at the 1% level.

targeting transfer payments towards those with limited labor ability rather than distributing them universally, thus mitigating any detrimental impact on residents' labor supply. So as to avoid the adverse impact on residents' labor supply. Education is important in raising residents' income (Cheng et al., 2014). Unconditional cash transfers alone are insufficient for achieving poverty alleviation through education. In order to address this, it is imperative for the government to undertake extensive public awareness campaigns and educational initiatives on poverty alleviation. Moreover, it is crucial to convert a portion of the transfer payments into conditional cash transfers specifically designated for reducing the schooling expenses of children from impoverished families, encompassing provisions such as free meals and learning essentials. This targeted approach can effectively enhance capital utilization efficiency. Addressing residents' health issues and restoring their labor capacity stands out as a primary measure in combating poverty, particularly in China's short-term poverty alleviation efforts. However, in the long run, fostering human capital development through education holds the key to sustainable poverty reduction and mitigating instances of relapse.

Data availability

The data used in this paper can be found in the Center for Social Survey (CSS) of Sun Yat-sen University, but a data use agreement with the data provider is required. The China Labor-force Dynamic Survey (CLDS) data use agreement states that our study will strictly comply with confidentiality obligations, protect and respect the respondents in the survey data obtained from the CSS by properly storing the study data, and shall not disclose, distribute, or transfer the data in part or in whole (including in converted form) to any other third party in any form without permission. The datasets used in the paper are not publicly available due to the confidentiality obligations of the agreement. However, anyone wishing to access the data may visit the website (http://css.sysu.edu.cn) to obtain permission to use the data through a reasonable request for the CSS.

Notes

1 According to official documents such as the 《Measures for the Management of Poverty Alleviation Funds》 and 《Measures for the Management of Central Financial Special Poverty Alleviation Funds》, the rural residents who meet specific criteria, including inability to support elderly family members, lack of work capacity or employment opportunities, absence of a sustainable livelihood source, or an annual per capita net income below the local rural subsistence allowance standard are eligible to apply for relevant cash subsidies. The amount and types of subsidies provided vary based on individual household circumstances. Moreover, due to regional disparities in development levels, subsidy also differ across different areas. For instance, according to statistical data from China's Ministry of Civil Affairs, approximately 34.892 million individuals receive minimum social security benefits in rural regions with an average annual amount of 6298.8 Yuan per person. For detailed information regarding specific transfer payment policies in a particular province, readers are encouraged to contact the author.

2 The phenomenon of labor disengagement refers to individuals who possess the ability to work but do not actively participate in employment, resulting in a unemployment. According to the data from the "National Survey of Low-Income Rural Families (2017)" (10.18170/DVN/YVGMIG), the proportion of poverty attributed to labor disengagement and major familial illnesses accounted for 13.87% and 31.29%, respectively.

3 Using these two datasets offers two key advantages: (1) It can ensure the robustness of empirical conclusions; (2) Comparing results from different years reveals changes in the impact of transfer payments on poverty alleviation.

4 According to the indicators in the questionnaire, categorized into four distinct groups (as shown in Table 2). Among these, wage income encompasses salaries, subsidies, and bonuses received by individuals actively employed within households (excluding retirement benefits). Operating income to earnings derived from production and operational activities such as retail establishments and family-run workshops. Property income refers to revenue generated from both movable and immovable assets (such as bonds, funds, land holdings, factory buildings, etc.).

5 We have employed both Kernel and Radius methods in our analysis, and the results obtained from these different approaches are consistent with each other. Therefore, we present the findings of the nearest neighboring method in the main text while providing those of other methods in the appendix.

6 From 2012 to 2022, China's cumulative fiscal expenditure on basic living assistance funds reached 2.04 trillion Yuan, with in-kind assistance serving as a pivotal approach (Source: Ministry of Civil Affairs of the People's Republic of China). In-kind assistance encompasses diverse provisions for livelihood and production, including food, clothing, and fertilizers, among others. For instance, children in impoverished regions are provided with complimentary lunches while destitute households receive fresh meat, fish, and rice (https://news.cgtn.com/news/2020-09-26/Ten-years-on-the-launch-of-China-s-free-lunch-campaign-U69VLPdlSM/index.html; https://www.gov.cn/zhengce/2022-07/29/content_5720567.htm).

7 China has successfully achieved the establishment of clinics staffed by qualified doctors in every village. Since 2018, the medical insurance poverty alleviation policy has benefitted a total of 480 million impoverished individuals, resulting in a reduction of nearly 330 billion yuan in their medical burden. Moreover, the out-of-pocket expenditure ratio for these underprivileged individuals ranges from approximately 6% to 22% (Source: China National Medical Insurance Administration).

8 Engel's Law posits that the proportion of income allocated to food purchases diminishes with increasing household income, while the percentage devoted to other expenditures escalates. The Engel's coefficient, derived from this law, is computed by dividing food expenses expenditures. This metric is employed by the United Nations (UN) for gauging and mitigating global poverty.

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Author contributions

YM contributed to the conception and design of the research. All authors contributed to the methodology, data collection, analysis, writing, review, and editing. All authors read and approved the final manuscript.

Competing interests

The authors declare no competing interests.

Ethical approval

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

Informed consent

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