Chapter 7
Human Capital and Rural Residents' Poverty Dynamic Changes

The lack of human capital is one of the root causes for the high poverty headcount ratio in developing countries and also one of the critical reasons for the formation of "poverty trap". Education, as an essential element of human capital, plays an important role in getting rural households out of poverty. Under-education results in low-level human capital, indicating that the poor can only engage in simple work and low-income work. It is detrimental to agricultural production and labor transfer. In addition, education is not only related to the employment and poverty alleviation of this generation but also related to the poverty alleviation of the next generation. It was found that the poorer the rural households, the lower the average education years have, as the poor rural households always have difficulty in paying relatively high education and training costs. It is quite possible that the children of poor rural households will remain poor in the future due to a lack of education, resulting in the intergenerational transmission of poverty.

In this chapter, the rural households are divided into different groups based on their income and education levels, and the impact of growth and inequality on the poverty level of each group of rural households is studied.

1 Growth, Inequality and Poverty of Rural Households with Different Education Levels

1.1 Statistics on the Education Levels of Rural Residents

In recent years, the education level of rural labor has been improved to some extent. According to the data from CHIPs, rural households were divided into illiterate rural households (with 0–3 education years), rural households with primary school education (3–6 education years), rural households with junior high school education (6–9 education years), and rural households with senior high school education or

Table 1 Statistics on education levels

	1988	1995	2002	2007	2013	2018
Illiterate rural households	31.7	50.1	26.1	8.6	6.9	3.5
Rural households with primary school education	35.5	23.1	25.8	27.0	32.6	32.2
Rural households with junior high school education	25.7	21.7	38.2	52.9	48.4	49.9
Rural households with senior high school education or above	7.1	5.1	9.9	11.5	12.2	14.4

Data source CHIPs data over the years, collated by the author. The statistical data here refers to the education level of the household head

above (more than 9 education years) based on the education years of the household heads. As shown in Table 1, the proportion of illiterate rural households decreases significantly, with the illiteracy rate dropping from 31.7% in 1988 to 8.6% in 2007 and further dropping to 3.5% in 2018.[1] The proportion of rural households with primary school education drops from 35.5% in 1988 to 27.0% in 2007, slightly rises after 201 and reaches 32.2% in 2018. The number of rural households with junior high school education relatively increases, with the proportion rising from 25.7% in 1988 to 52.9% in 2007 and dropping to 49.9% in 2018. The proportion of rural households with senior high school education or above rises from 7.31% in 1988 to 11.43% in 2007 and further to 14.4% in 2018. In general, with the economic development and the emphasis on the education of rural residents, the education level of rural households has increased. However, the education level of most rural household heads remains at primary school or junior high school (only receive the nine-year compulsory education), and the absolute number of rural households with senior high school education or above is still small. It indicates that the overall level of education and stock of human capital in rural areas is still very low.

1.2 Income Growth and Poverty Change: 1988–2007

Due to the different income statistical criterions used by the National Bureau of Statistics of China, the income changes of rural households with different education levels from 1988 to 2007 and those after 2007 were analyzed respectively based on the survey time structure of CHIP data.

The data from 1988 to 2007 show that the incomes of rural households with different education levels increase, while the increased range and absolute growth level of the average income are different in each group of rural households. The per capita income of illiterate rural households rises from RMB545 in 1988 to RMB1783

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[1] What should be noted is the substantial increase in the proportion of illiterate households in 1995. Based on date backtracking, the number of households with education years less than three in the sample sharply increases to 4003. Therefore, the data in 1995 do not represent the change trend of illiteracy rate nationwide.

in 2007, representing an annual growth rate of 6.4%; the per capita income of rural households with primary school education rises from RMB627 in 1988 to RMB1969 in 2007, with an annual growth rate of 6.2%; the per capita income of rural households with junior high school education rises from RMB654 in 1988 to RMB2114 in 2007, showing an annual growth rate of 6.37%; the per capita income of rural households with senior high school education or above, which is the highest and fastest-growing, rises from RMB721 in 1988 to RMB2564 in 2007, with an annual growth rate of 6.9%. In general, the higher the education level of the household head, the higher the per capita income level of the rural households. Of course, the income growth levels of different groups of rural households are different in different periods. The incomes of the three groups of rural households with relatively low education levels grow slowly in the initial stage (1988–2002), and the growth rate gradually increases in the later stage. The income growth rates of such three groups of rural households from 2002 to 2007 exceed that of rural households with senior high school education or above for the first time, and the per capita income of rural households with primary school education even increases by 11.4% during this period (Table 2). The phenomenon mentioned above indicates that the rural households with low education levels have benefited from the economic development in recent years, and their income growth mainly comes from working outside or the government's favorable policies for rural households.

The changes in FGT index of different groups of rural households in different periods are shown in Table 3. Firstly, the poverty levels of different groups of rural households are compared. As expected, illiterate rural households are the poorest in the past years due to low income, and the poverty index of rural households with senior high school education or above is the lowest. For example, in 2007, the poverty

Table 2 Basic information of rural households with different education levels

Type of rural households	Per capita net income (RMB yuan)				Average annual growth rate of income (%)			
	1988	1995	88–95	88–95	88–95	95–02	02–07	88–07
Illiterate rural households	545	731	1123	1783	4.3	6.3	9.7	6.4
Rural households with primary school education	627	855	1147	1969	4.5	4.3	11.4	6.2
Rural households with junior high school education	654	905	1329	2114	4.8	5.6	9.7	6.4
Rural households with senior high school education or above	721	1132	1749	2564	6.7	6.4	8.0	6.9

Data source CHIPs data over the years, collated by the author
Note From 1988 to 2012, the statistical criterion adopted by the National Bureau of Statistics of China for the per capita income of rural households was net income. The income during this period was calculated at the 1980 constant prices. The National Bureau of Statistics of China has adjusted the statistical criterion for rural residents' income to the concept of "disposable income" since 2013, thus the data before 2013 and after that year are not comparable. Therefore, 2013 constant prices were used for the calculation of income in 2013–2018

Table 3 Changes in poverty indexes of rural households with different education levels

Official absolute poverty line

	$\alpha = 0$				$\alpha = 1$				$\alpha = 2$			
	1988	1995	2002	2007	1988	1995	2002	2007	1988	1995	2002	2007
Illiterate rural households	0.066	0.131	0.033	0.025	0.017	0.044	0.009	0.030	0.007	0.022	0.005	0.152
Rural households with primary school education	0.029	0.109	0.032	0.014	0.008	0.038	0.009	0.014	0.003	0.018	0.005	0.085
Rural households with junior high school education	0.037	0.095	0.026	0.014	0.013	0.031	0.007	0.015	0.006	0.015	0.003	0.100
Rural households with senior high school education or above	0.041	0.084	0.011	0.010	0.009	0.031	0.003	0.012	0.003	0.017	0.001	0.037
All	0.059	0.116	0.028	0.015	0.017	0.039	0.008	0.016	0.008	0.020	0.004	0.093

Low-income line

Types of rural households	$\alpha = 0$				$\alpha = 1$				$\alpha = 2$			
	1988	1995	2002	2007	1988	1995	2002	2007	1988	1995	2002	2007
Illiterate rural households	0.390	0.304	0.108	0.042	0.119	0.102	0.025	0.030	0.053	0.051	0.011	0.103
Rural households with primary school education	0.311	0.244	0.082	0.028	0.084	0.084	0.021	0.016	0.033	0.043	0.010	0.057
Rural households with junior high school education	0.293	0.211	0.061	0.022	0.083	0.071	0.016	0.016	0.037	0.036	0.007	0.066
Rural households with senior high school education or above	0.258	0.160	0.035	0.015	0.063	0.061	0.007	0.012	0.026	0.034	0.003	0.027
All types of rural households	0.390	0.263	0.076	0.025	0.116	0.089	0.019	0.017	0.051	0.045	0.008	0.062

"USD1 per person per day"

Types of rural households	$\alpha = 0$				$\alpha = 1$				$\alpha = 2$			
	1988	1995	2002	2007	1988	1995	2002	2007	1988	1995	2002	2007
Illiterate rural households	0.738	0.611	0.324	0.109	0.304	0.248	0.099	0.048	0.160	0.133	0.044	0.062
Rural households with primary school education	0.663	0.550	0.283	0.103	0.251	0.213	0.083	0.034	0.123	0.112	0.036	0.036

(continued)

Table 3 (continued)

Rural households with junior high school education	0.680	0.503	0.212	0.084	0.250	0.185	0.061	0.029	0.123	0.096	0.027	0.038
Rural households with senior high school education or above	0.668	0.352	0.114	0.065	0.232	0.140	0.032	0.020	0.105	0.078	0.014	0.019
All types of rural households	0.765	0.562	0.250	0.089	0.310	0.221	0.074	0.031	0.160	0.118	0.033	0.037

Data source CHIPs data over the years, collated by the author

Note (1) All the calculated results have passed the hypothesis testing at the 5% level of significance; (2) The per capita net income of rural households and the poverty line are calculated at 1980 constant prices

headcount ratio (H-index) of rural households with senior high school education or above under the low-income line is only 1.5%, while that of illiterate rural households reaches 4.2%, indicating that the lower the level of education, the poorer the rural households. When the coefficient of relative risk aversion is raised, the ranking of poverty levels of rural households with different education levels will change slightly, and the poverty ranking of all groups of rural households is regionally consistent. What is noticeable is that the poverty indexes of rural households with junior high school education are close to or even higher than those of rural households with primary school education in some cases (this phenomenon was particularly remarkable in 1988). This interesting phenomenon may be due to the fact that the difference between the primary school education level and junior high school education level does not significantly affect the labor productivity of rural households. Instead, the opportunity cost of continuing a junior high school education is higher (rural households with primary school education spend more time in agricultural production and thus accumulate more wealth). However, there is a significant difference in the poverty levels of rural households with very low education levels and very high education levels, indicating that education is still essential for rural households to get rid of poverty.

In addition, it can be found that the FGT index change trends in different groups under different poverty lines are different in different periods. Under the higher poverty line ("USD1 per person per day"), the poverty of rural households is alleviated gradually; if the poverty line declines, the poverty index fluctuates irregularly. For example, only the H-index under the low-income line and the official absolute poverty line decrease mildly, and the other FGT indexes show an upward-downward-upward trend.[2] In our opinion, this fluctuation of the poverty depth and intensity is mainly due to the complexity of the income distribution in each group of rural households with different education levels.

Overall, the education level is inversely proportional to the poverty level, and the higher the education level, the lower the poverty level of the group. It indicates that attention should be paid to the education of low-educated rural households to help them get rich by promoting their human capital.

1.3 Income Growth and Poverty Change: 2013–2018

The details from 2013 to 2018 are as follows. First, the income changes of rural households with different education levels are shown in Table 4. The data show that the incomes of rural households with varying levels of education rise. The per capita income of illiterate rural households rises from RMB8389 in 2013 to

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[2] This does not account for the sharp increase in poverty level of households from 1995 to 2002. In terms of the change trend of the national poverty indexes (see Chap. 5), the poverty is generally improved. Therefore, the reason for sudden increase of the poverty indexes may be the fact that more poor people are covered in the CHIPs data sample. For this reason, the income inequality in each group increases substantially.

Table 4 Basic information of rural households with different education levels

	Per capita disposable income (RMB yuan)		Average annual growth rate of income (%)
	2013	2018	2013–2018
Illiterate rural households	8389	11,979	7.4
Rural households with primary school education	9285	14,049	8.6
Rural households with junior high school education	11,840	16,816	7.3
Rural households with senior high school education or above	14,398	20,780	7.6

Data source CHIP 2013–2018, collated by the author

RMB11,979 in 2018, representing an annual growth rate of 7.4%; the per capita income of rural households with primary school education rises from RMB9285 in 2013 to RMB14,049 in 2018, with an annual growth rate of 8.6%; the per capita income of rural households with junior high school education rises from RMB11,840 to RMB16,816, showing an annual growth rate of 7.3%; the per capita income of rural households with senior high school education or above, which is the highest, rises from RMB14,398 to RMB20,780, with an annual growth rate of 7.6%. Generally, the higher the education level of the household head, the higher the per capita income of the rural households. Of course, the income growth levels of different groups of rural households are different in different periods. The incomes of the three groups of rural households with relatively low education levels grow slowly in the initial stage (1988–2002), but the growth rate gradually increases later. From 2013 to 2018, the income growth rate of rural households with primary school education is higher than that of rural households with senior high school education or above, and the growth rate of rural households with different education levels is similar. It indicates that rural households with low education levels have benefited from economic development, and their income growth mainly comes from working outside or the government's favorable policies for rural households.

The changes in the FGT index of different groups of rural households in different periods are shown in Table 5. In terms of the poverty levels among all groups of rural households, the poverty index of illiterate rural households is the highest due to their low income, and the poverty index of rural households with senior high school education or above is the lowest, which is in line with expectations. Such results are also consistent with the analysis results of 1988–2007. However, during this period, the government raised the absolute standard of the rural poverty line significantly (review Chap. 1) to cover the poor. Therefore, the absolute value of the poverty level measured in this stage is not comparable to the previous stage. In terms of the poverty headcount ratio, under the low-income line of 2013, the poverty headcount ratio (H-index) of rural households with senior high school education or above is 3.0%, while that of illiterate rural households is as high as 9.0%, and the latter is three times as high

Table 5 Changes in poverty indexes of rural households with different education levels

	2013 (%)			2018 (%)		
	$\alpha = 0$	$\alpha = 1$	$\alpha = 2$	$\alpha = 0$	$\alpha = 1$	$\alpha = 2$
Illiterate rural households	9.0	2.6	1.2	3.9	1.3	0.8
Rural households with primary school education	6.5	2.0	1.0	2.6	1.0	0.6
Rural households with junior high school education	6.3	2.2	1.2	2.8	0.8	0.3
Rural households with senior high school education or above	3.0	1.3	0.7	1.2	0.7	0.4

Data source CHIPs data over the years, collated by the author
Note The per capita disposable income of rural households and the poverty line are calculated at 2013 constant prices

as the former. It indicates that education level and human capital are still important factors restricting rural households from getting higher income. When the coefficient of relative risk aversion is raised, the ranking of poverty levels of rural households with different education levels will change slightly, and the poverty ranking of all groups of rural households is regionally consistent. It can also be observed that the various poverty indexes of rural households with junior high school education are close to or even exceed those of rural households with primary school education in some cases (for example, $\alpha = 1$ and $\alpha = 2$ in 2013, and $\alpha = 0$ in 2018). On the whole, there is a significant difference between the poverty levels of rural households with the lowest education level and rural households with the highest education level, indicating that the education level is still substantial for rural households to get out of poverty.

2   Decomposition Study

The impact of income growth and inequality changes on the poverty level of rural households with different education backgrounds analyzed by Shapley Value Decomposition Method is shown in Table 6. As the statistical criterions of income before 2013 and after 2013 were incomparable, 2013 was taken as the boundary, and analysis was carried out in two periods.

2.1   Poverty Decomposition: 1988–2007

From the perspective of the overall decomposition results: (1) For each group of rural households, income growth contributes to poverty elimination, while the increased inequality is not conducive to poverty reduction. However, the negative value ΔD

Table 6 H-index decomposition results of rural households with different education levels: 1988–2007

	Low-income line				"USD1 per person per day"			
	1988–1995	1995–2002	2002–2007	1988–2007	1988–1995	1995–2002	2002–2007	1988–2007
Illiterate rural households								
ΔH	−0.086	−0.197	−0.066	−0.347	−0.126	−0.288	−0.216	−0.627
ΔE	−0.153	−0.148	−0.084	−0.408	−0.141	−0.241	−0.248	−0.652
ΔD	0.067	−0.049	0.018	0.061	0.015	−0.047	0.032	0.026
ΔPG	−0.017	−0.076	0.005	−0.088	−0.056	−0.149	−0.051	−0.254
ΔE	−0.054	−0.064	−0.010	−0.111	−0.093	−0.141	−0.039	−0.273
ΔD	0.037	−0.012	0.015	0.023	0.038	−0.007	−0.012	0.019
ΔSPG	−0.002	−0.040	0.093	0.053	−0.026	−0.090	0.018	−0.096
ΔE	−0.028	−0.030	0.013	−0.014	−0.061	−0.080	−0.011	−0.134
ΔD	0.026	−0.010	0.080	0.067	0.035	−0.010	0.029	0.037
Rural households with primary school education								
ΔH	−0.067	−0.161	−0.054	−0.283	−0.111	−0.267	−0.179	−0.559
ΔE	−0.159	−0.088	−0.074	−0.334	−0.161	−0.178	−0.217	−0.604
ΔD	0.091	−0.073	0.019	0.051	0.050	−0.089	0.038	0.045
ΔPG	0.000	−0.063	−0.005	−0.067	−0.038	−0.129	−0.049	−0.217
ΔE	−0.048	−0.037	−0.015	−0.091	−0.089	−0.095	−0.060	−0.244
ΔD	0.048	−0.025	0.009	0.024	0.051	−0.035	0.011	0.027
ΔSPG	0.009	−0.033	0.048	0.026	−0.011	−0.076	−0.001	−0.086
ΔE	−0.023	−0.018	0.008	−0.018	−0.055	−0.050	−0.021	−0.118
ΔD	0.032	−0.015	0.040	0.044	0.045	−0.025	0.021	0.032

(continued)

Table 6 (continued)

	Low-income line				"USD1 per person per day"			
	1988–1995	1995–2002	2002–2007	1988–2007	1988–1995	1995–2002	2002–2007	1988–2007
Rural households with junior high school education								
ΔH	−0.082	−0.150	−0.039	−0.270	−0.178	−0.291	−0.128	−0.595
ΔE	−0.163	−0.098	−0.049	−0.306	−0.206	−0.232	−0.152	−0.614
ΔD	0.082	−0.052	0.010	0.036	0.027	−0.060	0.023	0.019
ΔPG	−0.012	−0.055	−0.000	−0.067	−0.065	−0.124	−0.032	−0.220
ΔE	−0.049	−0.039	−0.010	−0.088	−0.105	−0.103	−0.040	−0.242
ΔD	0.037	−0.016	0.009	0.021	0.041	−0.020	0.008	0.022
ΔSPG	−0.001	−0.028	0.059	0.031	−0.026	−0.069	0.011	−0.084
ΔE	−0.024	−0.018	0.011	−0.014	−0.061	−0.053	−0.012	−0.115
ΔD	0.023	−0.010	0.048	0.045	0.035	−0.016	0.023	0.030
Rural households with senior high school education or above								
ΔH	−0.096	−0.125	−0.020	−0.243	−0.310	−0.237	−0.050	−0.602
ΔE	−0.182	−0.059	−0.025	−0.300	−0.337	−0.177	−0.083	−0.602
ΔD	0.086	−0.065	0.004	0.057	0.027	−0.060	0.033	−0.001
ΔPG	0.000	−0.053	0.005	−0.050	−0.090	−0.107	−0.012	−0.211
ΔE	−0.056	−0.030	−0.003	−0.079	−0.147	−0.080	−0.019	−0.232
ΔD	0.055	−0.024	0.008	0.029	0.057	−0.028	0.007	0.021
ΔSPG	0.008	−0.031	0.024	0.002	−0.026	−0.064	0.006	−0.085
ΔE	−0.028	−0.015	0.002	−0.026	−0.077	−0.041	−0.006	−0.112
ΔD	0.036	−0.015	0.022	0.027	0.051	−0.023	0.012	0.027

Data source CHIPs data over the years, collated by the author

Note All the calculated results have passed the hypothesis testing at the 5% level of significance

from 1995 to 2002 and the decomposition results of the positive value ΔE of the high-order poverty index (SPG index) of some years are exceptions. The former shows that inequality narrowing, together with the growth factor, plays a positive role in poverty reduction; the latter indicates that a comprehensive survey of the income inequality among the poor and growth under existing conditions is not conducive to reducing the inequality and alleviating poverty within the group. (2) The poverty levels of all groups of rural households from 2002 to 2007 are alleviated slightly. From the perspective of decomposed elements, this is mainly caused by the sharp slowdown of the impact of growth factor on poverty alleviation. However, Table 7 shows that the average income level of each group of rural households in the same period increased significantly, indicating a weak pro-poor growth within the group during this period,[3] but the increase of income within the group fails to drive the income growth of the poor. (3) The time series decomposition from 1988 to 2007 shows that the positive effect of income growth exceeds the negative effect of income redistribution, and the poverty of each group has been significantly alleviated.

For the variation of poverty change among different groups of rural households, the lower the education level, the higher the poverty reduction degree. For example, under the low-income line from 1988 to 2007, the H-index of illiterate rural households decreases by 0.374, rural households with primary school education decreases by 0.283, rural households with junior high school education decreases by 0.270, and rural households with senior high school education or above decreases by 0.243, indicating that economic growth is more conducive to rural households with lower education level. For illiterate rural households, the ΔSPG under the low-income line gradually increases, but the inter-temporal changes of the other poverty indexes show an upward-downward trend over time. This phenomenon further demonstrates the slowdown of poverty reduction in the recent period. Moreover, the decomposition results reveal that the slowdown of poverty alleviation is mainly due to the reduction in the impact of income growth on poverty alleviation. For example, in terms of the H-index under the low-income line, the ΔE from 1995 to 2002 is decreased by $0.005 \ (-0.148 - (-0.153))$ compared with the ΔE from 1988 to 1995, but the ΔE from 2002 to 2007 is decreased by $0.064 \ (-0.084 - (-0.148))$ compared with the ΔE from 1995 to 2002. Exceptionally, from 2002 to 2007, the PG index and SPG index under the absolute poverty line have increased (a positive value appears), but the reasons for the increase of the two indexes are not the same: the main reason for the rise in the PG index is that the impact of income growth on poverty reduction is lower than the effect of the widened income inequality on poverty; the reason for the increase of the SPG index is that income growth during this period is not conducive to the decline of the SPG index, and the growth and inequality enlarge the ΔSPG simultaneously. The changes in the poverty levels of the other three groups of rural households are similar to that of illiterate rural households: the poverty indexes show an upward-downward trend. The ΔSPG of three groups of rural households below the low-income line shows a positive value, indicating that economic growth has rarely benefited the people living in extreme poverty in the recent period.

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[3] For a detailed discussion of pro-poverty, please refer to the previous chapters.

2.2 Poverty Decomposition: 2013–2018

Generally, from the perspective of the decomposition results: (1) From 2013 to 2018, if the poverty headcount ratio is used as a measurement index, both income growth and inequality change conduce to poverty eradication for each group. However, if PG ($\alpha = 2$) or SPG ($\alpha = 2$) is taken as the measurement index, inequality change still shows a negative effect on poverty eradication. (2) The effect of income growth on poverty reduction is generally higher than the inequality change. Exceptionally, for rural households with senior high school education and above, it is observed that the effect of within-group income inequality on poverty reduction is higher than the income growth.

Then the variation of poverty change among different groups of rural households is compared. From the perspective of the poverty headcount ratio, the poverty reduction effect of illiterate rural households and rural households with senior high school education or above is higher, indicating that economic growth during this period has a better impact on poverty alleviation for groups at both ends. The benefit on rural households with high income is mainly due to their grasp of economic opportunities in marketization. For illiterate rural households, this mainly depends on the effect of large-scale poverty alleviation policies implemented by the Chinese government during targeted poverty alleviation (Table 7).

Table 7 H-index decomposition results of rural households with different education levels: 2013–2018

	Illiterate rural households	Rural households with primary school education	Rural households with junior high school education	Rural households with senior high school education or above
ΔH	−0.0599	−0.0455	−0.0259	−0.0248
ΔE	−0.0496	−0.0420	−0.0242	−0.0099
ΔD	−0.0095	−0.0031	−0.0014	−0.0147
ΔPG	−0.0159	−0.0115	−0.0045	−0.0083
ΔE	−0.0146	−0.0120	−0.0078	−0.0042
ΔD	−0.0011	0.0006	0.0035	−0.0040
ΔSPG	−0.0053	−0.0046	−0.0004	−0.0037
ΔE	−0.0065	−0.0055	−0.0039	−0.0030
ΔD	0.0013	0.0010	0.0036	−0.0006

Note The poverty line is RMB2300 (at 2010 constant prices), which is the result after the annual CPI deflation

3 Elasticity Analysis by Education Levels

3.1 Growth Elasticity Analysis

Table 8 shows the income growth elasticity of rural households with different education levels during the investigation period. The data before and after 2013 are incomparable, so each period was analyzed separately. The growth elasticity of H-index of all groups of rural households from 1988 to 2013 increases gradually. For example, under the official low-income line, the poverty elasticity of illiterate rural households increases from −1.56 to 1.99 in 1995, and then to -3.29 in 2002 and −3.24 in 2007, indicating that the impact of income growth on reducing the poor residents

Table 8 Income growth elasticity of rural households with different education levels

Type of rural households	Official low-income line				RMB2300 standard	
	1988	1995	2002	2007	2013	2018
H						
Illiterate rural households	−1.563	−1.990	−3.285	−3.236	−1.977	−2.011
Rural households with primary school education	−1.461	−1.738	−2.661	−3.041	−2.517	−1.540
Rural households with junior high school education	−1.481	−1.483	−1.990	−2.313	−1.902	−0.978
Rural households with senior high school education or above	−1.531	−1.036	−1.277	−1.789	−1.445	−0.623
PG						
Illiterate rural households	−2.221	−2.264	−3.857	−0.701	−1.822	−0.327
Rural households with primary school education	−1.946	−1.792	−2.992	−0.736	−1.227	0.269
Rural households with junior high school education	−1.675	−1.563	−2.119	−0.38	−0.676	0.886
Rural households with senior high school education or above	−1.406	−1.111	−1.516	−0.168	0.373	1.401
SPG						
Illiterate rural households	−2.575	−2.255	−3.239	2.346	−0.007	0.005
Rural households with primary school education	−2.005	−1.849	−2.855	1.329	1.842	0.595
Rural households with junior high school education	−1.755	−1.584	−1.895	1.609	1.248	4.669
Rural households with senior high school education or above	−1.214	−1.207	−1.176	0.473	3.237	4.861

Data source CHIPs data over the years, collated by the author
Note All the calculated results have passed the hypothesis testing at the 5% level of significance

has gradually strengthened. The values of elasticity for the PG index and SPG index have also increased over time but dropped sharply in 2007, making it difficult for the income growth rate of 1% to increase the PG index measured by the poverty gap and showing even a positive value for the SPG index, which focuses on the people living in the extreme poverty. In our opinion, it is probably caused by the increase in people living in extreme poverty in the group. Then the changes in the values of elasticity for each group of rural households during this period are compared. In 1988, every 1% increase in income can reduce the H-index of illiterate rural households, rural households with primary school education, rural households with junior high school education, and rural households with senior high school education or above by 1.56%, 1.46%, 1.48%, and 1.53%, respectively. However, there are no significant differences among the values of elasticity at this time. As time goes by, the income polarization among rural households with different education levels has been enlarged, and the gaps of the values of elasticity in various groups have also increased. As of 2007, for every 1% increase in income, the H-index of the four groups of rural households decreases by 3.24%, 3.04%, 2.31%, and 1.79%, respectively. The inequality in growth elasticity of poverty among the four groups has widened. The income growth shows a more significant effect on the poverty reduction of rural households with lower education levels (PG index and SPG index show similar changing trends, but the absolute value of elasticity is relatively small), indicating that growth is more conducive to the poverty reduction of low-educated rural households since the twenty-first century.

From 2013 to 2018, the values of elasticity obtained for the H-index are all negative, indicating that growth improves the poverty of all groups of rural households. However, for the PG and SPG indexes, except for illiterate rural households from 2013 to 2018 and rural households with primary school education and junior high school education in 2013, the PG indexes are all positive. It demonstrates that the proportional income change within the group may increase the poverty gap and the square poverty gap by widening the absolute value of the inequality within the group. From the perspective of the income growth elasticity of the four groups of rural households, the value of elasticity of each group is different. Generally, the H-index survey results show that the elasticity of income in poverty reduction for low-educated rural households is higher, while that of higher-educated rural households is lower as their poverty level is already low. According to the PG and SPG study, rural households with relatively low education levels have higher growth elasticity of poverty reduction, but the PG and SPG values for rural households with higher education levels gradually turn from negative to positive, and the higher the education level, the greater the positive value. It is because that fewer people with high education levels fall into poverty, and the poverty level of people in the group is higher, and the proportional income increase further widens the inequality of the poor, enlarging the PG index, which is more sensitive to the relatively poor rural households, and the SPG index, which is more sensitive to the inequality.

In general, income growth shows a more significant effect on poverty reduction for rural households with lower education levels, and as time goes on, this effect has been strengthened. Since the data show that the income growth of rural households

with low income is an effective measure to alleviate the poverty of illiterate rural households, every effort should be made to increase the income of low-educated rural households to help them get rid of poverty. Of course, it is also vital to improve the rural education resources and create a favorable education environment for poor rural households.

3.2 Inequality Elasticities Analysis

Table 9 lists the inequality elasticity of the poverty index. Generally, the value of elasticity increases with the rise of the poverty aversion index α, and decreases with

Table 9 Inequality elasticities of rural households with different education levels

	1988	1995	2002	2007	2013	2018
H						
Illiterate rural households	0.41	1.66	5.73	11.92	6.70	10.60
Rural households with primary school education	0.59	1.64	5.18	11.54	5.64	7.68
Rural households with junior high school education	0.65	1.57	4.33	9.19	4.52	5.61
Rural households with senior high school education or above	0.89	1.32	3.13	7.08	3.37	4.26
PG						
Illiterate rural households	1.8	4.96	11.33	13.98	9.00	4.00
Rural households with primary school education	1.71	4.2	10.66	9.25	7.63	3.73
Rural households with junior high school education	1.6	3.96	7.81	7.76	5.65	4.29
Rural households with senior high school education or above	1.45	3.45	5.72	5.14	5.50	3.80
SPG						
Illiterate rural households	3.09	6.39	12.4	7.47	3.14	0.26
Rural households with primary school education	2.45	5.33	13.93	3.93	5.07	1.19
Rural households with junior high school education	2.46	4.86	9.07	4.17	3.93	5.49
Rural households with senior high school education or above	1.88	4.59	5.5	2.23	7.51	4.96

Data source CHIPs data over the years, collated by the author
Note All the calculated results have passed the hypothesis testing at the 5% level of significance (2)
MII marginal effect of income polarization on inequality, *MIP* marginal effect of income polarization on poverty, *ELS* inequality elasticity of poverty

the rise of the poverty line. In most cases, the coefficient of elasticity is positive, indicating that income polarization is not conducive to the poverty reduction of each group of rural households.

Specifically: (1) The value of elasticity is small in 1988 (for example, the value of elasticity for the H-index under the low-income line of illiterate rural households is only 0.41). The value of elasticity of low-educated rural households is smaller, indicating that income polarization has little impact on poverty, and widened inequality at this time is disadvantageous for the rural households with high education levels. The H-index under the poverty line of "USD1 per person per day" is even negative, showing that moderate income polarization in the early stage of reform and opening-up is conducive to reducing the poor residents. (2) In 1995, the values of elasticity of rural households with various education levels increase. Take the measurement results under the low-income line as an example: 1% income polarization in 1995 increases the H-index of rural households (with the education levels from low to high) by 1.66%, 1.64%, 1.57%, and 1.32%, respectively; in 2002, the H-index of each group of rural households increases by 5.73%, 5.18%, 4.33%, and 3.13%, respectively; in 2007, the H-index of each group of rural households increases by 11.92%, 11.54%, 9.19%, and 7.08%, respectively. (3) From 2013 to 2018, although the absolute value of elasticity is not comparable to that in the previous period, the inequality elasticity continues to increase.

The absolute values of growth elasticity of poverty and inequality elasticity are compared. Obviously, in the early stage of reform and opening-up (1988), a 1% income polarization causes a lower degree of poverty deterioration, and it is even more unfavorable for rural households with high education levels. In contrast, a 1% increase in income can significantly reduce poverty and play a more significant role in the poverty reduction of rural households with lower education levels. For example, in 1988, the growth elasticities of poverty for the four groups under the low-income line (with the education levels from low to high) are -1.56, -1.46, -1.48, and -1.53, respectively, with corresponding inequality elasticities of 0.41, 0.59, 0.65 and 0.89, respectively. In the recent period, the effect on poverty reduction brought by the same degree of growth is significantly lower than the effect on poverty deterioration brought by the same degree of income polarization. For example, in 2007, the growth elasticities for the four groups of rural households under the low-income line (with the education levels from low to high) are -3.24, -3.04, -2.31, and -1.89, respectively, with corresponding inequality elasticities of 11.92, 11.54, 9.19 and 7.08, respectively. In addition, the widened income inequality during this period has a more prominent effect on the poverty of rural households with low education levels. In this sense, more attention should be paid to controlling the income inequality of rural households with low education levels while promoting their income growth.

In general, the inequality within the group is detrimental to poverty reduction. The widening of income inequality is unfavorable for high-educated rural households in the early stage and is detrimental to low-educated rural households in the recent period. In addition, the value of elasticity in this period is significantly higher than that in previous periods, and the rural households with low education levels are unable to bear the impact of income inequality and income polarization.

3.3 Analysis on Subsidy Effect of All Groups of Rural Households

The study on the potential benefits of some unimplemented reform projects is as important as the evaluation of the effectiveness of existing projects, and the former has more significant reference value—considering the specific administrative reasons or the cost of reforms, some ongoing projects cannot be changed or corrected timely. However, if some reform projects have been implemented, we can assess their potential utility based on existing parameters. The policy simulation can independently explore the possible marginal well-being effects of certain potential reform projects, so as to provide theoretical guidance for future anti-poverty policy reforms. Public works for poverty alleviation and conditional cash transfer payments are essential elements of poverty alleviation. This funding project can directly provide subsidies to poor rural households, so as to prevent children from dropping out of school, help the poor get medical attention, and improve their nutrition status, etc. Therefore, it is meaningful to study the impact of fixed cash subsidies on rural households. To enhance the accuracy of positioning of poverty alleviation and assist the specific groups of rural households in proper ways, it is recommended to use diversified poverty alleviation methods to ensure that the anti-poverty goal is achieved more efficiently and more limited financial funds are used for the people and regions (or households) in need most. The relevant policy recommendations will be provided based on this, and the impact of government subsidies and price adjustments on poverty alleviation is measured through policy simulation.

The simulation methods used include: (1) RMB1500 per capita is provided to people in different groups under different classification conditions, and (2) income-based proportional subsidies (10%) are provided to people in different groups. Take 2018 as the investigation year (see Table 10).

Table 10 Impact of fixed subsidies and proportional subsidies on the poverty status of rural households with different education levels: 2018

	Fixed subsidies (RMB500 per person)			Proportional subsidies (20%)		
	H	PG	SPG	H	PG	SPG
Illiterate rural households	−0.016	−0.009	−0.010	−0.007	−0.002	0.001
Rural households with primary school education	−0.012	−0.008	−0.023	−0.006	0.002	0.068
Rural households with junior high school education	−0.008	−0.008	−0.040	−0.004	0.006	0.536
Rural households with senior high school education	−0.005	−0.006	−0.051	−0.002	0.009	0.563

Data source CHIP 2018, collated by the author

Note (1) All the calculated results have passed the hypothesis testing at the 5% level of significance; (2) Assume that the subsidy is RMB100 per capita. (3) The fixed subsidy rate is 10% of per capita income

First, if a fixed subsidy was adopted, the marginal effect of such subsidy on the H-index of illiterate rural households, rural households with primary school education, rural households with junior high school education, and rural households with senior high school education and above will be −0.016, −0.012, −0.008, and −0.0058, respectively. The subsidy shows the most significant poverty reduction effect on illiterate rural households, followed by rural households with primary school education, and then rural households with junior high school education. For rural households with senior high school education or above, that is, rural households with the highest education level, the marginal effect of fixed subsidies is the least. The proportional subsidies show a similar impact on various groups but a low marginal poverty reduction effect.

In addition, for the same group of rural households, the calculated results based on different poverty lines or different FGT indexes are different. Generally, the impact of subsidies measured by a higher poverty line on poverty alleviation is higher, as the rise of the poverty line expands the coverage of the poor residents and the scope of subsidies, inevitably producing more significant poverty reduction effects. (Table 11 lists the data calculated based on the 2007 results for a supplement, which compares the low-income line with the "USD1 per person per day" line). Under the same poverty line, the calculated results based on different FGT indexes are irregular,

Table 11 Impact of fixed subsidies and proportional subsidies on the poverty status of rural households with different education levels: 2007

	Fixed subsidies (RMB500 per person)			Proportional subsidies (20%)		
	H	PG	SPG	H	PG	SPG
Low-income line						
Illiterate rural households	−1.968	−1.03	−1.484	−0.02	−0.02	−0.001
Rural households with primary school education	−1.854	−0.693	−0.782	−0.019	−0.019	−0.002
Rural households with junior high school education	−1.415	−0.548	−0.783	−0.014	−0.014	−0.004
Rural households with senior high school education	−1.108	−0.368	−0.599	−0.011	−0.011	−0.001
"USD1 per person per day"						
Illiterate rural households	−4.087	−1.61	−1.428	−0.041	−0.001	−0.001
Rural households with primary school education	−3.784	−1.534	−1.006	−0.038	−0.004	−0.003
Rural households with junior high school education	−3.011	−1.247	−0.865	−0.03	−0.007	−0.005
Rural households with senior high school education	−2.529	−0.959	−0.6	−0.025	−0.001	−0.001

Note (1) All the calculated results have passed the hypothesis testing at the 5% level of significance; (2) Assume that the subsidy is RMB100 per capita (at 1980 constant price). (3) The fixed subsidy rate is 25%

mainly related to the distribution of the poor residents within the group. Generally, the poverty alleviation effect measured under higher-order poverty indexes will be reduced, as the impact of subsidies on the income distribution of the poor residents within the group is different. The subsidies can directly and significantly reduce the poor population, but they show little impact on improving the poverty distribution in the group, especially when there are a large number of poor people living in extreme poverty in the group or the income polarization of the poor people is relatively severe.