

# Poverty Reduction Effect of Chinese Foreign Aid to Africa: An Empirical Study Based on Panel Data of 48 Recipient Countries

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**Abstract.** This research examines the impact and mechanisms of poverty alleviation associated with Chinese aid to African countries, utilizing comprehensive panel data from the 2000-2017 timeframe. A detailed exploration of salient indicators - the headcount ratio, poverty gap, and poverty severity - has been conducted to critically evaluate the efficacy of this aid. The study substantiates that Chinese aid meaningfully ameliorates the headcount ratio, lessens the poverty gap, and mitigates poverty severity in the recipient countries. Further examination of mechanisms reveals that the principal stratagem of reducing poverty resides in the proliferation of capital accumulation, fostering job generation, and advancing human capital development in the recipient countries. An assessment of varied outcomes demonstrates Chinese aid to be most potent in poverty alleviation in countries characterized by diminished per capita income and lower corruption indices. When compared, Official Development Assistance (ODA) exerts a more pronounced impact on curtailing poverty severity than other official aids, which have a more potent influence on reducing poverty incidence. Mixed aid-types demonstrate superior efficacy in decreasing poverty incidence, with development aid showing remarkable proficiency in addressing poverty depth and severity. This investigation significantly broadens the existing discourse on the poverty-reduction impact of Chinese foreign aid, offering invaluable insights and articulate points of reference for the enhancement of collaborative strategies in poverty alleviation policy between nations.

**Keywords:** Chinese Foreign Aid; African Countries; Poverty Reduction.

## 1. Introduction

Poverty, especially in developing nations, has long presented a significant challenge to the international community. Addressing this issue is not only a moral obligation but also crucial for achieving sustainable development goals. In response to this urgent challenge, governments and global organizations have implemented various measures, including the formulation of comprehensive poverty reduction policies, with foreign aid playing a key role in international collaborative efforts. As the world's most populous developing country, China has achieved remarkable success in poverty reduction. These achievements have earned widespread domestic and international recognition and provide valuable lessons for other countries. China's approach to poverty reduction reflects its unique "Chinese wisdom" and "Chinese solutions". Since the mid-1950s, China has actively provided aid to African nations, demonstrating a steadfast commitment to fostering sustainable development across the continent. China's assistance covers critical areas such as infrastructure development, technology transfer, human resource development, and agricultural cooperation. These aid initiatives have not only supported the economic advancement of African nations but also played a vital role in reducing poverty rates and improving social development [1, 2, 3, 4]. This paper aims to examine the role of Chinese aid in poverty reduction in Africa, exploring the positive effects of aid in addressing poverty challenges in African countries. It also investigates the mechanisms through which aid contributes to poverty reduction in Africa. By comprehensively analyzing these factors, we aim to enhance our understanding of the effectiveness of foreign aid in poverty alleviation and provide more robust guidance for future poverty reduction policies and international cooperation. Moreover, we anticipate that the findings of this study will contribute valuable experiences and insights to global poverty reduction efforts, facilitating coordinated responses to global poverty challenges and advancing the achievement of sustainable development objectives.

The effectiveness of foreign aid in achieving development objectives has long been a subject of debate. While existing research on the impact of foreign aid on economic growth yields conflicting results, multiple studies strongly suggest that foreign aid can effectively promote economic growth [5, 6, 7, 8]. However, economic growth, though commonly seen as a crucial tool for reducing poverty, does not always lead to poverty reduction [9]. One argument posits that economic growth should naturally and steadily benefit the broader population, ultimately resulting in a decrease in poverty levels [10]. However, despite an average growth rate of 5% in African countries between 2000 and 2015, poverty levels in most African nations did not see significant reductions, raising questions about the effectiveness of foreign aid in poverty reduction. Some studies support the idea that targeted aid plays a positive role in alleviating poverty in developing countries [11, 12, 13]. Conversely, an opposing view argues that aid may perpetuate a cycle of poverty and undermine sustainable economic growth [14, 15, 16, 17]. Additionally, some studies take a middle-ground position, suggesting that the impacts and effectiveness of aid can vary depending on factors such as donor allocation strategies, recipient country governance, commitment levels, project ownership, and institutional capacity [22]. In summary, the role and effectiveness of foreign aid are complex and multifaceted, influenced by various interacting variables. Comprehensive research and systematic analysis are essential for a deeper understanding of the influence of aid on development objectives.

In recent years, there has been significant progress in research on China's foreign aid. Existing studies have primarily focused on strategic planning, historical evolution, and policy frameworks. However, there is a noticeable lack of empirical research examining the poverty reduction effects of China's foreign aid. This can be attributed to various constraints, including limited access to and transparency of official Chinese aid data. Previous empirical studies have mainly concentrated on specific regions or countries, such as those involved in the Belt and Road Initiative, low and middle-income nations, and Latin American states [23, 24, 25]. However, research on China's aid and investments in Africa has been relatively limited. Existing studies have mainly approached this issue qualitatively or considered broader economic and social impacts [26]. Empirical research has primarily focused on China's trade development, investment effects, and the role of investments in poverty reduction in Africa [27, 28, 29]. It is important to note that research on the poverty reduction effects and mechanisms of Chinese aid in Africa, encompassing various categories of aid, remains notably limited.

Building upon this, we utilize Chinese aid data to African nations in conjunction with poverty data sourced from the World Bank's Poverty and Inequality Platform (PIP) database. We conduct a comprehensive analysis of the poverty reduction effects of China's assistance to African countries from three perspectives: poverty incidence, depth, and intensity. This study aims to address the following research questions: Firstly, does China's aid contribute to poverty alleviation in African countries? Secondly, what are the mechanisms through which Chinese aid influences the poverty rate in African countries? Thirdly, do the effects of Chinese aid on poverty rates in African countries vary based on factors such as aid type and recipient country attributes (e.g., level of economic development, institutional quality)? Empirical research findings indicate that Chinese aid to African nations significantly reduces poverty across various dimensions, including poverty incidence, depth, and intensity. This effect remains consistent even after being subjected to a battery of robustness tests. Furthermore, further analysis reveals intriguing details. China's aid strategy for Africa adopts a multi-faceted approach, with official development assistance (ODA) playing a prominent role in alleviating poverty intensity, especially in severe cases. On the other hand, alternative forms of official aid, such as OOF and VOF, have a greater impact on reducing poverty incidence and aiding a larger number of households in escaping poverty. This difference can be attributed to variations in fund allocation and priority sectors among different types of aid. It is important to note that the effectiveness of official aid is not solely determined by its type. The degree of aid marketization also influences the poverty reduction effect. Blended aid, which incorporates market mechanisms to stimulate economic growth in recipient nations, demonstrates a

more significant impact in reducing poverty incidence. In contrast, development aid proves more effective in alleviating the depth and intensity of poverty by focusing on improving human capital and social infrastructure.

Furthermore, the impact of China's aid on poverty reduction varies depending on recipient countries' economic development stages and institutional quality. The findings indicate that the poverty reduction impact of China's aid becomes more apparent in countries with relatively lower per capita income and lower levels of corruption. This highlights the link between aid effectiveness and the economic and institutional context of recipient countries. To ensure optimal efficacy, aid policies should be tailored accordingly. Additionally, this study examines the mechanisms underlying the poverty reduction effects of China's aid. China's support for economic infrastructure, including transportation, energy, communication, and financial infrastructure, promotes capital accumulation and employment generation, thereby stimulating economic growth in African nations and ultimately reducing poverty. Moreover, China's investment in social infrastructure, such as education and healthcare, enhances human capital and strengthens the competitiveness of recipient countries, leading to further poverty reduction. In conclusion, this study provides a comprehensive investigation into the mechanisms and diversity of China's aid in poverty reduction, contributing to the understanding of aid policymakers. It can assist China in refining its aid policies to effectively address international aid challenges and offer valuable insights to the global community on collaborative efforts to reduce global poverty.

This research primarily contributes in three significant areas. Firstly, it addresses a research gap in the existing literature, which predominantly concentrates on specific regions such as Latin America while affording limited attention to African countries in the context of China's foreign aid and investments. Furthermore, within the domain of research exploring China's aid and investments in Africa, a majority of studies focus on probing the investment and poverty reduction implications of Chinese investments, consequently neglecting investigation into the poverty reduction effects of Chinese aid in African nations. This research addresses this lacuna by undertaking a comprehensive examination of China's aid data concerning African countries and poverty data from the PIP database. The analysis delves into the poverty reduction repercussions of Chinese assistance in African countries across three dimensions: incidence, depth, and intensity. By employing this extensive research lens, the study not only augments the existing literature on China's foreign aid but also bridges a significant knowledge gap related to the impact of aid in African nations. This contribution fosters a more inclusive understanding of the global South-South cooperation and international aid influence, thereby providing a valuable foundation for prospective research endeavors.

Secondly, this research offers nuanced policy recommendations by taking into account variations in aid types and recipient country characteristics, encompassing economic development levels and institutional quality. Through a thorough exploration, customized aid policies can be devised for diverse countries and regions, guaranteeing a more efficacious approach in mitigating poverty-linked challenges. Acknowledging the distinct needs of various countries and regions enables policymakers to calibrate their aid strategies to optimize the enhancement of economic growth and poverty reduction. This yields practical guidance to improve the execution of international aid and poverty reduction policies.

Lastly, this paper conducts an intricate analysis of China's aid in the economic and social infrastructure of African countries, delivering insights into the underlying mechanisms that drive the poverty reduction effects of Chinese aid. By scrutinizing the policy outcomes, a profound comprehension of China's foreign aid efficacy can be obtained, informing future policy development. Grasping the unique mechanisms of aid empowers policymakers to conceptualize strategies that generate a substantial impact on poverty alleviation efforts.

The paper is structured as follows: Section 2 outlines the research hypotheses pertaining to China's aid and its impact on poverty reduction in African nations. Section 3 focuses on the research design, encompassing sample selection and data processing. It also offers a detailed explanation of

the model data and the relevant variable settings utilized in this study. Section 4 is dedicated to empirical testing, which includes baseline regression, robustness tests, and an analysis of heterogeneity. Section 5 examines the operational mechanisms at play. Finally, Section 6 presents the conclusion.

## 2. Research Hypothesis

Chinese assistance to African nations plays a pivotal role in their poverty alleviation endeavors. Drawing on prior research, this paper investigates the internal mechanisms by which Chinese aid fosters poverty reduction in African nations, considering the developmental contexts of all 48 African countries and the unique attributes of China's assistance in Africa. <sup>1</sup>In particular, we analyze how China's infrastructure assistance influences poverty reduction in recipient nations, with a focus on the distribution of Chinese aid across Africa. This is primarily realized through mechanisms involving the effects on physical and human capital.

First, China's investment in economic infrastructure in recipient countries can generate tangible capital effects, fostering capital accumulation and job creation, and consequently, it significantly contributes to poverty reduction in African nations. Economic infrastructure, encompassing transportation, postal and telecommunications networks, and energy supply, functions as physical capital, actively engaging in the production process. This, in turn, contributes to augmenting social production capacity and expediting economic growth. Owing to insufficient infrastructure development funding, African nations significantly lag behind in this realm, characterized by low per capita figures for railways, roads, bridges, airports, and ports. This, to a certain extent, hampers economic progress. China, by assisting in the construction of economic infrastructure, aids recipient nations in mitigating infrastructure bottlenecks across sectors, including water resources, electricity, land transportation, aviation, and communication. This assistance fosters capital accumulation, bolsters economic prowess, enhances competitiveness in African countries, and ultimately yields poverty reduction outcomes. Notably, China's energy initiatives in Africa, including hydroelectric power stations, transmission and transformation projects, and natural gas power generation, will bolster the energy supply capabilities of African countries, enhance their power supply infrastructure, cut electricity expenses, and stimulate industrial advancement and modernization. Likewise, China's communication undertakings in Africa, comprising fiber-optic cable telecom transmission networks and fiber-optic backbone networks, will reduce communication expenses in African nations, facilitate the establishment of contemporary information networks, and encourage the growth of local e-commerce. Taking the Mombasa-Nairobi railway, a project funded with approximately \$3.8 billion, as an illustration, approximately 95% of the investment originated from concessional loans supplied by the Chinese government. Since its commencement in 2017, the Mombasa-Nairobi railway has notably enhanced transportation connectivity between Mombasa Port and Nairobi, effectively halving travel time while augmenting travel convenience. Concurrently, the railway's construction has led to the direct and indirect creation of over 46,000 job opportunities and the provision of technical and managerial training for more than 20,000 individuals. According to statistical data, the development of the Mombasa-Nairobi railway has propelled Kenya's GDP growth from 5.8% to 7.3%, contributing 1.5% to the nation's economic expansion.

Secondly, China's assistance in social infrastructure in Africa, particularly in education and healthcare, can substantially contribute to improving the educational and healthcare conditions of recipient nations. This, in turn, plays a pivotal role in augmenting human capital and subsequently fostering poverty reduction in African countries [30, 31]. Many recipient countries often grapple with inadequate medical and educational facilities, which hinder the formation and accumulation of human capital. China's support in healthcare and educational infrastructure enhances the human capital in recipient countries, ultimately stimulating economic growth. Human capital stands as a crucial factor within the production function that drives economic growth. It encompasses two key dimensions: the physical well-being of individuals, including life expectancy, physical strength,

endurance, and vitality, which are significantly influenced by healthcare and medical standards, and the productive capacity and skills of individuals, which can be enhanced through education and training. On the one hand, assistance in constructing educational infrastructure contributes to the enrichment of the educational human capital in recipient nations. China's initiatives involve the construction of schools, training centers, and various educational facilities in recipient countries, coupled with teacher training, elevating educational standards, optimizing resource utilization in education, strengthening the human capital and self-development capabilities of the recipient country, promoting the accumulation of human capital, and propelling economic development and poverty reduction [32]. On the other hand, support for the development of healthcare and essential health infrastructure enhances the healthcare human capital of recipient nations. China participates in the construction of hospitals, disease control centers, and other public health facilities in recipient countries, providing medical technology and equipment to aid these countries in improving healthcare conditions, extending life expectancy, and increasing labor force participation rates. Consequently, this augmentation of healthcare human capital in recipient countries further drives economic growth and contributes to poverty reduction. In summary, we propose the following research hypotheses.

Hypothesis 1: China's economic infrastructure aid to Africa facilitates poverty reduction by stimulating capital accumulation and job creation in the region.

Hypothesis 2: China's social infrastructure aid to Africa contributes to poverty reduction by bolstering human capital

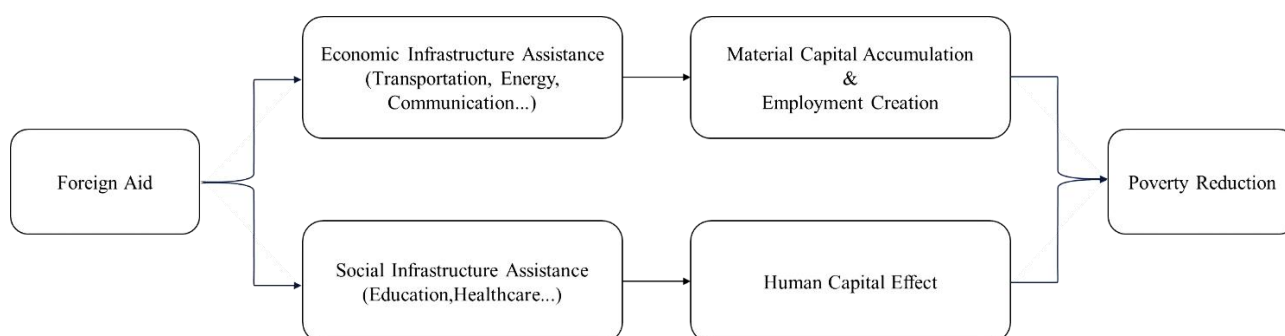


Fig. 1 Mechanisms of "foreign aid - poverty reduction"

### 3. Data and Empirical Strategy

#### 3.1 Data and Variable Construction

We selected panel data on China's aid to African countries from 2000 to 2017 as the research sample. The rationale behind the selection of this dataset can be primarily attributed to two key factors: Firstly, since 2000, amidst the rapid growth and ascension of the Chinese economy, the Chinese government has progressively recognized aid as a pivotal diplomatic policy and international cooperation instrument. Consequently, China's assistance to Africa has exhibited incremental growth, positioning it as one of the principal trading partners and contributors of foreign aid within the African continent. Hence, the dataset aptly captures the magnitude and influence of China's foreign aid to African nations, consequently facilitating a more comprehensive examination of the impact of Chinese aid on poverty reduction in Africa. Secondly, following 2000, advancements in information technology and enhanced data collection methodologies have led to a continuous enhancement in the quality and reliability of statistical data in African countries. Consequently, the selection of the 2000-2017 timeframe for the dataset offers improved assurances of data reliability and comprehensiveness. To ensure the precision and dependability of the research findings, we implemented the subsequent data preprocessing steps: (1) Exclusion of samples with significant missing data in the primary variables that were unsuitable for analysis. (2) In an effort to

mitigate the potential impact of outliers on the estimation outcomes, we winsored all continuous country-level variables at the 1% level on both tails.

The dependent variable is the poverty level, Poverty, across diverse African nations. Adhering to the human basic needs approach, BNA, the World Bank assesses poverty by employing monetary or income standards. It deems individuals impoverished if their living standards dip below the poverty threshold, which is defined as the income (or consumption) required to meet the minimum acceptable levels of nutrition and essential daily necessities. Consequently, the distinction between the poor and non-poor lies in the poverty line, which is determined based on specific income or expenditure criteria [33]. In the context of income poverty, we employ data on poverty from the World Bank's Poverty and Inequality Platform, PIP, database to assess the impact of China's assistance to African nations on poverty reduction. Three key indicators are employed for this evaluation: the Headcount Ratio (HR), Poverty Gap (PG), and Poverty Severity (PS). Specifically, HR represents the percentage of the population whose daily living expenses, calculated based on purchasing power parity in 2011, fall below the poverty standard of \$3.20 per day. It measures the overall prevalence of poverty based on the distribution of poverty within the population. However, it is important to note that while HR is the favored metric among researchers, its main limitation lies in its inability to gauge the extent of poverty [34]. PG considers the dispersion within the impoverished population, calculating the average proportional income gap from the poverty standard for each individual in the population. As a result, it provides insights into both the depth and prevalence of poverty. It can be construed as the per capita expenditure required for nationwide poverty eradication [34]. PS, in contrast, encompasses the weighted summation of poverty gaps, capturing income disparities within the impoverished population. It magnifies the condition of the most severely impoverished, making it sensitive to the occurrence of deep poverty among the poor [34, 35].

The independent variable is China's aid level to Africa, Aid, and it is quantified by the count of aid projects supplied by China to diverse African nations. This data is sourced from AidData, an internationally recognized dataset on foreign aid, hosted by the College of William & Mary in the United States. AidData comprehensively encompasses significant international aid projects on a global scale, providing critical data on aid quantities, project categories, beneficiary nations, and other vital particulars. The most recent update to this dataset was in 2021, and it comprises a total of 13,427 development projects financed by over 300 Chinese government agencies and state-owned entities. These projects span 165 countries across diverse regions and pertain to the period from 2000 to 2017. This dataset serves as a pivotal cornerstone for addressing our research inquiry, with subsequent sections subjecting variables, such as China's aid volume, to rigorous robustness assessments.

The control variable data are all sourced from the World Bank's World Development Indicators database (WDI). Specifically, these variables include (1) Share of Agricultural Population (RurPop). Agriculture continues to be the dominant economic activity in many countries, particularly in the developing world. The proportion of the population involved in agriculture is a pivotal metric for gauging a nation's economic composition. (2) Gross Capital Formation (GrossCap). Endogenous economic growth theories underscore the importance of amassing physical capital for economic growth and poverty alleviation. Nations that fail to invest in physical capital confront productivity limitations, potentially leading to entrenched poverty. Moreover, the shortage of physical capital can result in deficient regional infrastructure and lower levels of education and healthcare, with the potential for intergenerational poverty transmission. We employ the ratio of total capital formation to GDP in each African nation as a measure of Gross Capital Formation. (3) Degree of Openness to International Trade (Trade). Enhanced engagement in international trade, leading to increased exports, the attraction of foreign investment, and technological advancements, can catalyze economic growth and the generation of employment prospects, thereby reducing poverty rates. We employ the degree of openness to international trade by utilizing the ratio of total trade volume to GDP. (4) Level of Infrastructure (MobileSub). Public amenities and services, including robust

transportation and communication infrastructure at the country or regional level, bolster production efficiency by fostering market expansion and facilitating the movement of goods. This, in turn, generates additional employment prospects and provides further impetus for poverty reduction. Therefore, we gauge the level of infrastructure through the number of mobile phone users per 100 individuals. (5) Resource Endowment (Land). Countries or regions endowed with ample natural resources, human capital, and cultural assets can leverage these resource advantages to mitigate poverty rates. The proportion of arable land stands out as a vital gauge of resource endowment. We employ the share of arable land as a metric for resource endowment.

Definitions and descriptive statistics for the key variables are detailed in Table 1. In relation to the dependent variables, the mean values for the poverty headcount ratio, poverty gap, and poverty severity are 0.599, 0.299, and 0.184, respectively, accompanied by standard deviations of 0.27, 0.183, and 0.135. These figures highlight substantial disparities in poverty levels among the recipient nations in Africa. Additionally, with respect to the primary explanatory variable, the mean value for China's foreign aid stands at 7.981, with a standard deviation of 5.84, indicating significant disparity in China's aid levels across various countries. These descriptive statistics underpin our sample's robustness in exploring the influence of Chinese aid on recipient countries.

Table 1. Definition and descriptive statistics of main variables

Variable	Definition	N	Mean	SD	Min	Max
HR	Proportion of population living below the poverty line	568	0.599	0.270	0.0203	0.985
PG	Income level of the poor and average poverty line gap	568	0.299	0.183	0.00360	0.774
PS	Weighted sum of squares of poverty gaps	568	0.184	0.135	0.00130	0.635
Aid	Number of China's foreign aid projects to the country	568	7.981	5.840	1	41
RurPop	Share of agricultural population in total population	568	58.24	16.60	11.02	90.38
GrossCap	Share of gross capital formation in GDP	568	24.26	9.977	-3.946	79.40
Trade	Share of import and export trade in GDP	568	70.92	39.54	1.378	348.0
MobileSub	Cell phone subscribers per 100 population	568	56.50	40.59	0	164.3
Land	Percentage of arable land	568	14.22	13.27	0.0863	48.72

### 3.2 Identification Strategy

China's engagement with Africa has transformed from unilateral assistance into a multifaceted model encompassing economic aid and economic trade cooperation. This transition has been particularly noteworthy since the establishment of the Forum on China-Africa Cooperation (FOCAC). This transformation extends beyond mere economic and technological cooperation, reaching into various sectors such as economic trade and investment, exhibiting a continuous expansion in both breadth and depth. The pressing question at hand pertains to the practical efficacy of this collaborative development paradigm in alleviating poverty within African nations. Leveraging the research conducted by Gohou and Soumaré (2012) and Dreher (2021) [36, 37], we endeavor to evaluate the impact of China's aid on poverty reduction in African countries. The fundamental regression model is articulated as follows:

$$Poverty_{it} = \beta_0 + \beta_1 Aid_{it} + \gamma Z_{it} + \mu_i + \varepsilon_{it} \quad (1)$$

where the subscript  $i$  represents African countries,  $t$  represents the year,  $\beta_0$ ,  $\beta_1$ , and  $\gamma$  are the parameters to be estimated; the dependent variable  $Poverty_{it}$  represents the poverty level of African countries; the independent variable  $Aid_{it}$  represents China's aid level to African countries;  $Z_{it}$  represents a series of control variables, including the proportion of agricultural population (RurPop), accumulation of physical capital (GrossCap), degree of openness to international trade (Trade), level of infrastructure (MobileSub), and resource endowment (Land);  $\mu_i$  represents country-fixed effects, and  $\varepsilon_{it}$  represents the random error term.

## 4. Empirical Results and Analyses

To investigate the potential impact of Chinese aid on the poverty rates in African nations and to discern the underlying mechanisms at play, we conducted a series of empirical examinations. First, we employed the least squares method to assess the influence of Chinese aid on poverty rates in African countries. Second, we conducted robustness tests involving variations in the measurement methods of explanatory variables, adjustments to fixed effects, and modifications to control variables. Third, recognizing the considerable heterogeneity within Chinese aid to African countries, including aid types and recipient country attributes, such as economic development status and institutional quality, we undertook pertinent heterogeneity tests, focusing on the categories of Chinese aid and recipient country characteristics.

### 4.1 Foreign Aid and Poverty Reduction: Baseline Results

We employ the least squares method to investigate the impact of Chinese aid on poverty rates in African nations. The empirical test results are provided in Table 2. Specifically, the dependent variables in columns 1-2 of Table 2 represent HR, while columns 3-4 represent PG, and column 5-6 represent PS. Notably, the results in columns 1, 3, and 5 of Table 2 reveal that, in the absence of relevant control variables and with the sole consideration of country-level fixed effects, the coefficient estimate for Aid exhibits significant negativity at the 1% level.

To enhance the robustness of our findings, we conduct further analysis and interpretation of the regression outcomes by introducing pertinent control variables. The outcomes in columns 2, 4, and 6 of Table 2 demonstrate that, even after accounting for additional country-level characteristic variables such as the proportion of the agricultural population and the accumulation of physical capital, the coefficient estimates for Aid remain significantly negative at the 5% and 1% levels, respectively. These results strongly suggest that Chinese foreign aid leads to a reduction in poverty rates among African recipient countries, as evidenced by changes in headcount ratio, poverty gap, and poverty severity.

Table 2. Foreign aid and poverty reduction: baseline results

	HR		PG		PS	
	(1)	(2)	(3)	(4)	(5)	(6)
Aid	-0.0033*** (0.0007)	-0.0010** (0.0005)	-0.0035*** (0.0009)	-0.0016*** (0.0005)	-0.0030*** (0.0009)	-0.0015*** (0.0005)
RurPop		0.0023 (0.0034)		0.0024 (0.0036)		0.0021 (0.0035)
GrossCap		-0.0003 (0.0004)		-0.0010** (0.0005)		-0.0010** (0.0005)
Trade		0.0000 (0.0002)		-0.0001 (0.0002)		-0.0001 (0.0002)
MobileSub		-0.0008*** (0.0003)		-0.0004* (0.0002)		-0.0003 (0.0002)
Land		-0.0032 (0.0028)		-0.0108** (0.0042)		-0.0106** (0.0042)
Constant	0.6255*** (0.0059)	0.5749** (0.2167)	0.3270*** (0.0075)	0.3822* (0.2258)	0.2086*** (0.0073)	0.2722 (0.2179)
Observations	568	568	568	568	568	568
Adj R-squared	0.9663	0.9797	0.9327	0.9545	0.8982	0.9264
Country FE	YES	YES	YES	YES	YES	YES



Notes: \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% levels, respectively. The latter is the same.

## 4.2 Robustness checks

Firstly, to ensure the robustness of our results, we altered the measurement method of the independent variable and conducted relevant tests. We substituted the independent variable in the baseline regression, the number of Chinese foreign aid projects, with the amount of Chinese foreign aid and re-ran the regression. Results in columns 1-3 of Table 3 Panel A demonstrate that the coefficient estimates of aid amount are significantly negative at the 5% level. Additionally, we replaced the number of Chinese foreign aid projects with an aid dummy variable in the regression. The creation of the aid dummy variable is based on whether a country received Chinese aid in each year within the sample period, denoting 1 if it did and 0 if it didn't. Results in columns 4-6 of Table 3 Panel A reveal that the coefficient estimates of the Chinese foreign aid dummy variable are significantly negative at 1% or 5% levels. These findings indicate that under the new measurement approach for Chinese aid, its reduction of poverty rates in African recipient countries remains evident.

Table 3. Robustness checks

Panel A	Amount of aid			Aid dummy variable		
	(1) HR	(2) PG	(3) PS	(4) HR	(5) PG	(6) PS
Amount	-0.0006** (0.0003)	-0.0008** (0.0003)	-0.0007** (0.0003)			
Aid dummy				0.0221* (0.0120)	0.0216** (0.0092)	0.0182** (0.0071)
RurPop	0.0004 (0.0033)	0.0013 (0.0031)	0.0015 (0.0030)	0.0041 (0.0036)	0.0032 (0.0029)	0.0025 (0.0026)
GrossCap	-0.0006 (0.0008)	-0.0012 (0.0008)	-0.0012 (0.0008)	-0.0006 (0.0007)	-0.0013* (0.0007)	-0.0012* (0.0007)
Trade	0.0001 (0.0003)	-0.0001 (0.0003)	-0.0002 (0.0003)	0.0001 (0.0004)	-0.0001 (0.0003)	-0.0001 (0.0003)
MobileSub	-0.0011*** (0.0002)	-0.0006** (0.0002)	-0.0004* (0.0002)	-0.0010*** (0.0003)	-0.0006** (0.0002)	-0.0004* (0.0002)
Land	-0.0054 (0.0058)	-0.0214*** (0.0061)	-0.0218*** (0.0061)	-0.0067*** (0.0025)	-0.0116*** (0.0032)	-0.0105*** (0.0034)
Constant	0.7251*** (0.2301)	0.5897*** (0.2049)	0.4557** (0.1900)	0.4926** (0.2346)	0.3260* (0.1845)	0.2299 (0.1665)
Observations	529	529	529	652	652	652
Adj R2	0.9796	0.9575	0.9320	0.9687	0.9434	0.9161
Country FE	YES	YES	YES	YES	YES	YES
Panel B	Control year fixed effects			Control system quality variable		
	(1) HR	(2) PG	(3) PS	(4) HR	(5) PG	(6) PS
Aid	-0.0009** (0.0004)	-0.0014*** (0.0005)	-0.0013*** (0.0005)	-0.0011** (0.0005)	-0.0012** (0.0005)	-0.0011** (0.0005)
RurPop	0.0016 (0.0035)	0.0014 (0.0036)	0.0012 (0.0036)	0.0023 (0.0033)	0.0021 (0.0031)	0.0017 (0.0029)
GrossCap	-0.0005 (0.0006)	-0.0013 (0.0008)	-0.0012 (0.0007)	-0.0005 (0.0007)	-0.0009 (0.0008)	-0.0009 (0.0008)
Trade	0.0000 (0.0003)	-0.0001 (0.0003)	-0.0002 (0.0003)	-0.0001 (0.0003)	-0.0004 (0.0003)	-0.0004 (0.0003)

MobileSub	-0.0008*	-0.0002	0.0000	-0.0009***	-0.0005*	-0.0003
	(0.0005)	(0.0004)	(0.0004)	(0.0003)	(0.0002)	(0.0002)
Land	-0.0032	-0.0111**	-0.0110**	-0.0053	-0.0167***	-0.0161***
	(0.0039)	(0.0049)	(0.0047)	(0.0057)	(0.0057)	(0.0053)
WGI				0.0018	-0.0413	-0.0478
				(0.0367)	(0.0324)	(0.0291)
Constant	0.6143***	0.4343*	0.3209	0.6135**	0.4775**	0.3602*
	(0.2128)	(0.2333)	(0.2253)	(0.2358)	(0.2113)	(0.1869)
Observations	568	568	568	520	520	520
Adj R2	0.9798	0.9550	0.9273	0.9798	0.9551	0.9288
Country FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	NO	NO	NO

Secondly, considering that the poverty in African recipient countries may also be influenced by time-varying macroeconomic factors, such as global economic slowdown and international trade frictions, which can have adverse effects on the economic and social development of these countries and exacerbate poverty issues, we incorporated year fixed effects to ensure the robustness and reliability of the model. The results in columns 1-3 of Table 3 Panel B demonstrate that the coefficient estimates of the Chinese foreign aid variable remain significantly negative at 1% or 5% levels. This suggests that even when accounting for the impact of time-varying macroeconomic factors, Chinese aid continues to have a significant reducing effect on poverty rates in African recipient countries, affirming the robustness of our conclusions.

Lastly, a conducive institutional environment plays a pivotal role in a country's overall economic growth, resource allocation, and poverty alleviation. Drawing from Wang and Tian's research [38], we selected the global governance index from the World Bank Governance Indicators Database to measure the overall institutional quality of recipient countries and included it in the baseline regression as a control variable. Specifically, we computed the mean of six specialized indicators within the global governance index, which encompass voice and accountability, control of corruption, rule of law, regulatory quality, political stability, and government effectiveness. The results in columns 4-6 of Table 3 Panel B indicate that the coefficient estimates and significance levels of the Chinese foreign aid dummy variable remained largely unchanged, affirming the robustness of the conclusions drawn in our baseline regression.

### 4.3 Heterogeneity analysis

#### 4.3.1 Types of Aid

The form of aid can impact the poverty reduction outcomes of China's support to African nations. According to OECD Development Assistance Committee classification standards, Chinese foreign aid is divided into Official Development Assistance (ODA) and other official assistance, including OOFs and VOFs, and we analyze how these aid categories differ in poverty reduction effects. Table 4, Panel A, columns 1-3, provides estimates of China's ODA. While the estimated coefficient for HR lacks significance, the coefficients for PG and PS are both significantly negative at the 1% level. According to columns 4-6, other official assistance estimates are significantly negative at the 5% level for HR and PG but not significant for PS. This contrast may primarily stem from the concentration of ODA in domains like emergency relief and humanitarian aid, which exhibit greater variability. Although ODA aids in mitigating short-term and sudden poverty in recipient nations, its sustained impact on poverty reduction remains limited. Conversely, other official assistance, encompassing OOF and VOF, is typically of greater scale and relates to investment, development, production, trade, and resource development. Thus, poverty reduction is more substantiated through these initiatives that enhance capital accumulation and foster employment.

Table 4. Heterogeneity based on type of foreign aid

Panel A	ODA	OOF/VOF
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	(1) HR	(2) PG	(3) PS	(4) HR	(5) PG	(6) PS			
Aid	-0.0011 (0.0007)	-0.0021*** (0.0007)	-0.0021*** (0.0006)	-0.0011** (0.0005)	-0.0013** (0.0006)	-0.0011 (0.0007)			
RurPop	0.0025 (0.0034)	0.0026 (0.0036)	0.0023 (0.0035)	0.0026 (0.0035)	0.0031 (0.0036)	0.0028 (0.0036)			
GrossCap	-0.0003 (0.0004)	-0.0010** (0.0005)	-0.0010** (0.0005)	-0.0003 (0.0004)	-0.0009* (0.0005)	-0.0009* (0.0005)			
Trade	0.0000 (0.0002)	-0.0001 (0.0002)	-0.0001 (0.0002)	-0.0000 (0.0002)	-0.0002 (0.0002)	-0.0002 (0.0002)			
MobileSub	-0.0008*** (0.0003)	-0.0004* (0.0002)	-0.0003 (0.0002)	-0.0008*** (0.0003)	-0.0005* (0.0002)	-0.0003 (0.0002)			
Land	-0.0032 (0.0027)	-0.0106** (0.0041)	-0.0105** (0.0041)	-0.0035 (0.0029)	-0.0111** (0.0044)	-0.0110** (0.0044)			
Constant	0.5627** (0.2165)	0.3706 (0.2256)	0.2630 (0.2168)	0.5529** (0.2179)	0.3395 (0.2302)	0.2295 (0.2226)			
Observation	568	568	568	568	568	568			
Adj R2	0.9796	0.9544	0.9264	0.9795	0.9534	0.9244			
Country FE	YES	YES	YES	YES	YES	YES			
Panel B	Development			Commercial			Mixed		
	(1) HR	(2) PG	(3) PS	(4) HR	(5) PG	(6) PS	(7) HR	(8) PG	(9) PS
Aid	-0.0009 (0.0007)	-0.0019* (0.0006)	-0.0019* (0.0006)	-0.0027 (0.0021)	-0.0017 (0.0015)	-0.0008 (0.0013)	-0.0013* (0.0005)	-0.0010* (0.0006)	-0.0008 (0.0007)
RurPop	0.0024 (0.0035)	0.0022 (0.0036)	0.0019 (0.0035)	0.0028 (0.0035)	0.0033 (0.0037)	0.0031 (0.0036)	0.0029 (0.0034)	0.0034 (0.0036)	0.0031 (0.0036)
GrossCap	-0.0003 (0.0004)	-0.0010* (0.0005)	-0.0010* (0.0005)	-0.0003 (0.0004)	-0.0009* (0.0005)	-0.0009* (0.0005)	-0.0003 (0.0004)	-0.0010* (0.0005)	-0.0009* (0.0005)
Trade	-0.0000 (0.0002)	-0.0001 (0.0002)	-0.0001 (0.0002)	-0.0000 (0.0002)	-0.0002 (0.0002)	-0.0002 (0.0002)	-0.0000 (0.0002)	-0.0001 (0.0002)	-0.0002 (0.0002)
MobileSub	-0.0009* (0.0003)	-0.0005* (0.0002)	-0.0003 (0.0002)	-0.0008* (0.0003)	-0.0005* (0.0002)	-0.0003 (0.0002)	-0.0008* (0.0003)	-0.0005* (0.0002)	-0.0003 (0.0002)
Land	-0.0032 (0.0028)	-0.0106* (0.0041)	-0.0105* (0.0041)	-0.0035 (0.0029)	-0.0112* (0.0045)	-0.0110* (0.0045)	-0.0035 (0.0029)	-0.0111* (0.0044)	-0.0110* (0.0045)
Constant	0.5694* (0.2188)	0.3909* (0.2269)	0.2851 (0.2172)	0.5411* (0.2178)	0.3231 (0.2326)	0.2142 (0.2246)	0.5355* (0.2150)	0.3195 (0.2306)	0.2122 (0.2235)
Observation	568	568	568	568	568	568	568	568	568
Adj R2	0.9796	0.9544	0.9265	0.9795	0.9531	0.9240	0.9795	0.9532	0.9241
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

Assistance projects with varying degrees of market orientation also yield differing poverty reduction effects. Panel B of Table 4 presents the poverty reduction effects of development-oriented, business-oriented, and hybrid assistance projects in columns 1-9, respectively. The results reveal that mixed assistance projects significantly promote the reduction of poverty incidence, whereas development-oriented and Commercial-oriented assistance projects do not exhibit significant effects in reducing poverty incidence. This disparity may stem from the fact that mixed assistance projects

typically employ a diversified approach, encompassing both economic development and considerations for social and environmental aspects, thus addressing the multifaceted needs of recipient countries. This comprehensive approach provides support across various domains, ranging from economic growth to the provision of social services, offering a more holistic form of assistance to recipient countries. Furthermore, the introduction of market mechanisms may encourage recipient countries to take a more proactive stance, nurturing their self-reliance in poverty alleviation, which includes better resource management, both economically and socially, thereby fostering sustainable development.

#### 4.3.2 Recipient Country Characteristics

Various factors, such as the economic development level, political stability, social and cultural context, and natural environment of recipient countries, may influence the poverty reduction effects of China's foreign aid [39]. In this section, we investigate the impact of recipient country characteristics, focusing on economic development levels and institutional quality, on the poverty reduction effects of China's assistance to African countries.

The impact of China's foreign aid on poverty reduction in recipient countries may be influenced by the economic development level of these nations. In low-income countries, China's assistance is often concentrated on essential areas such as infrastructure development, healthcare, and education, which are typically urgent needs for poverty alleviation. China's support can contribute to infrastructure construction, enhance the quality of education and healthcare services, and aid in improving human capital and economic growth. Therefore, China's aid can significantly affect poverty reduction in low-income countries. For middle-income countries, assistance may focus more on supporting industrial development, technology cooperation, and trade collaboration. These countries may have already made progress in infrastructure and education, so China's aid can further support economic diversification and innovation, which are critical for long-term poverty reduction and sustainable development. High-income countries may engage in cooperation with China rather than relying on aid. This collaboration can encompass investments, technology transfers, and trade. In this scenario, China's involvement can boost the economic growth of recipient countries, but the direct poverty reduction impact may be relatively limited.

To validate this conclusion, we categorized African countries into low-income and high-income countries based on the World Bank classification standards,<sup>2</sup> using per capita Gross National Income (GNI) as the criterion. The results of the group regression are presented in Panel A of Table 5. Columns 1-3 represent the impact of China's aid on poverty reduction in low-income countries. The estimated coefficients of Aid are significantly negative, consistent with the baseline regression results, indicating that China's assistance has a significant poverty reduction effect in low-income African countries. Columns 4-6 represent the impact of China's aid on poverty reduction in high-income countries, where the estimated coefficients of Aid are not significant. This may be due to the fact that low-income countries often lack funding and technology, face more severe poverty and economic development challenges, making it difficult for them to achieve independent development. They require more external aid to promote economic development and poverty reduction. In these countries, China's aid can provide necessary financial and technical support for infrastructure construction, water supply and sanitation improvement, as well as technical training. Thereby, these assistances help these nations increase production efficiency, generate employment opportunities, improve the well-being of their citizens, achieve economic transformation, sustainable development, and subsequently promote economic development and poverty reduction.

The quality of a recipient country's institutions can constrain the utilization of aid resources received, thereby influencing the poverty reduction effects of China's foreign aid [19, 40]. In countries with higher institutional quality, the utilization of aid resources is more transparent and efficient, and oversight mechanisms are more robust. In turn, this lessens the likelihood of corruption and resource theft, ensuring that aid money is directed toward achieving sustainable development and poverty reduction goals. Furthermore, preserving property rights and contractual duties, encouraging investment, and promoting economic growth all depend critically on the

existence of a strong and established rule of law environment. As a consequence, it bolsters the potential for poverty reduction in recipient countries. Countries characterized by high institutional quality tend to excel in the harmonization of policies, aligning aid initiatives with national development strategies. This, in turn, ensures the enduring sustainability of aid projects and their contributions to poverty reduction. Most notably, nations endowed with robust institutional quality often embrace open, inclusive, and responsive government systems that promote extensive civic engagement. This enhances the feasibility of aid initiatives and actively involves the inhabitants of recipient countries to guarantee a more responsive alignment of aid efforts with their specific needs.

Table 5. Heterogeneity based on economic development and institutional quality of recipients

Panel A	Low-income			High-income		
	(1) HR	(2) PG	(3) PS	(4) HR	(5) PG	(6) PS
Aid	-0.0011** (0.0005)	-0.0017** (0.0006)	-0.0017** (0.0007)	-0.0010 (0.0014)	-0.0013 (0.0011)	-0.0011 (0.0009)
RurPop	0.0058 (0.0049)	0.0052 (0.0056)	0.0049 (0.0053)	0.0017 (0.0041)	0.0001 (0.0023)	-0.0011 (0.0029)
GrossCap	-0.0008* (0.0004)	-0.0014* (0.0007)	-0.0013* (0.0007)	0.0001 (0.0009)	-0.0004 (0.0006)	-0.0004 (0.0005)
Trade	-0.0000 (0.0004)	-0.0002 (0.0004)	-0.0002 (0.0004)	0.0001 (0.0003)	0.0000 (0.0001)	-0.0000 (0.0001)
MobileSub	-0.0001 (0.0004)	-0.0000 (0.0004)	0.0001 (0.0004)	-0.0013*** (0.0003)	-0.0008*** (0.0002)	-0.0006** (0.0002)
Land	-0.0063* (0.0035)	-0.0120* (0.0060)	-0.0112* (0.0059)	-0.0064 (0.0063)	-0.0124*** (0.0031)	-0.0123*** (0.0021)
Constant	0.4685 (0.3334)	0.2650 (0.3745)	0.1298 (0.3454)	0.4840* (0.2501)	0.4330*** (0.1376)	0.4037** (0.1742)
Observations	381	381	381	183	183	183
Adj R2	0.9678	0.9233	0.8878	0.9808	0.9799	0.9719
Country FE	YES	YES	YES	YES	YES	YES
Panel B	Low-corruption			High-corruption		
	(1) HR	(2) PG	(3) PS	(4) HR	(5) PG	(6) PS
Aid	-0.0012** (0.0005)	-0.0019*** (0.0006)	-0.0019*** (0.0006)	-0.0005 (0.0007)	-0.0003 (0.0006)	-0.0001 (0.0004)
RurPop	0.0012 (0.0041)	0.0022 (0.0044)	0.0023 (0.0043)	0.0068 (0.0076)	0.0049 (0.0037)	0.0035 (0.0023)
GrossCap	-0.0004 (0.0005)	-0.0013** (0.0006)	-0.0013** (0.0006)	-0.0000 (0.0006)	-0.0001 (0.0004)	-0.0000 (0.0002)
Trade	0.0001 (0.0003)	-0.0001 (0.0003)	-0.0001 (0.0003)	-0.0001 (0.0002)	-0.0001 (0.0002)	-0.0001 (0.0001)
MobileSub	-0.0009*** (0.0003)	-0.0004 (0.0003)	-0.0002 (0.0003)	-0.0005 (0.0007)	-0.0003 (0.0004)	-0.0002 (0.0003)
Land	-0.0028 (0.0030)	-0.0110** (0.0043)	-0.0108** (0.0043)	-0.0048 (0.0160)	-0.0028 (0.0094)	-0.0014 (0.0060)
Constant	0.6795**	0.4379	0.2978	0.1665	0.0074	-0.0262

	(0.2661)	(0.2830)	(0.2747)	(0.5209)	(0.2645)	(0.1610)
Observations	463	463	463	105	105	105
Adj R2	0.9745	0.9454	0.9140	0.9839	0.9789	0.9793
Country FE	YES	YES	YES	YES	YES	YES

To validate this conclusion, we used the 2010 Corruption Perceptions Index published by Transparency International (TI) to measure the institutional quality of recipient countries. This index assesses the perceived level of corruption in the public sector across 178 countries, with higher scores indicating a less corrupt public sector. Based on the sample data's mean values, we categorized countries into high-corruption and low-corruption groups. The results of the group regression are presented in Panel B of Table 5. Columns 1-3 represent the impact of China's aid on poverty reduction in low-corruption countries. The estimated coefficients of the core explanatory variable, China's foreign aid, are significantly negative, consistent with the baseline regression results, indicating that China's aid has a more significant poverty reduction effect in low-corruption countries. Columns 4-6 represent the impact of China's aid on poverty reduction in high-corruption countries, where the estimated coefficients of the core explanatory variable are not significant. This may be because countries with low corruption place a greater emphasis on aid effectiveness and efficient utilization, enabling them to better leverage aid resources for economic and social development. Moreover, countries with low corruption typically have a more conducive investment environment and better governance capacity, which further facilitates the implementation of aid projects and the realization of poverty reduction effects.

## 5. Foreign Aid and Poverty Reduction: Potential Mechanisms

Based on the previous research hypotheses, China's aid plays a pivotal role in substantially reducing poverty rates in recipient countries. This impact is primarily manifested in two key aspects. This form of aid not only facilitates capital accumulation and job creation but also bolsters human capital, thereby establishing robust conditions for achieving poverty reduction effects.

Firstly, China's investments in Africa, particularly in economic infrastructure encompassing transportation networks, energy supply, communication systems, and financial infrastructure, have had a profound impact on the economic growth of recipient countries. These infrastructure developments not only boost productivity but also expand market opportunities and trade prospects, thus creating additional avenues for capital accumulation. Simultaneously, these projects generate a substantial number of employment opportunities, benefiting a diverse spectrum of individuals ranging from engineers and technical workers to management personnel and operations staff. This contributes to reducing unemployment rates, enhancing livelihoods, and mitigating the burden of poverty.

Secondly, Chinese aid places a significant emphasis on social infrastructure, specifically in the domains of education and healthcare. By supporting school construction, providing educational resources, and improving the accessibility of healthcare services, Chinese aid contributes to enhancing human capital in recipient countries. This, in turn, offers residents of these countries improved educational opportunities, heightened skill levels, and increased competitiveness in the job market. Furthermore, enhancing healthcare services can mitigate the risk of poverty arising from health-related issues and enhance people's overall quality of life.

In summary, China's aid, with its multifaceted support in both economic and social infrastructure, synergistically promotes poverty reduction effects. This comprehensive assistance not only augments a nation's productive capacity but also reinforces the capabilities of its people, enabling them to better address the challenges posed by poverty. This aid mechanism not only assists in addressing current poverty issues but also lays a robust foundation for the sustainable development of recipient countries.

Table 6. Foreign Aid and Poverty Reduction: Potential Mechanisms

	Industry (1)	Employment (2)	Health (3)	Education (4)
Aid	0.1254** (0.0492)	0.2066** (0.1003)	0.0144*** (0.0051)	0.0212*** (0.0072)
RurPop	0.4060* (0.2021)	-1.3521* (0.7248)	0.0433* (0.0217)	0.0418 (0.0465)
GrossCap	-0.0838 (0.0672)	-0.0410 (0.0405)	0.0045 (0.0043)	0.0069 (0.0071)
Trade	0.0645*** (0.0231)	-0.0396 (0.0327)	0.0008 (0.0021)	0.0043 (0.0040)
MobileSub	0.0105 (0.0141)	-0.0440 (0.0357)	0.0050** (0.0021)	0.0047 (0.0031)
Land	0.2859 (0.2311)	0.1470 (0.1544)	-0.0250 (0.0306)	-0.0093 (0.0288)
Constant	-6.5911 (13.0212)	94.6098* (47.8166)	-1.0436 (1.5071)	0.7230 (2.9556)
Observations	552	406	550	425
Adj R2	0.9215	0.9575	0.8882	0.8911
Country FE	YES	YES	YES	YES

To empirically investigate the mechanisms through which Chinese aid impacts poverty reduction in recipient countries, this section primarily assesses whether Chinese foreign aid affects the recipient country's industrial value added as a proportion of GDP, employment rates, government health expenditure as a percentage of GDP, and government education expenditure as a percentage of GDP, and their implications for the poverty rate. Therefore, based on the fundamental regression model, this study conducts individual regressions with the variables mentioned above as dependent variables, as shown in Table 6. The results indicate that Chinese aid significantly boosts the recipient country's industrial value added, employment rates, health expenditure, and education expenditure. This suggests that Chinese aid can stimulate capital accumulation, promote local industrialization, enhance employment opportunities, and generate additional income sources for local residents. Furthermore, Chinese aid increases health and education expenditure levels in recipient countries, contributing to the well-being and knowledge levels of the population, thus providing increased social security and educational prospects for impoverished communities. This substantiates the mechanisms previously discussed regarding the impact of Chinese aid on poverty reduction in recipient countries.

## 6. Conclusion

This study utilizes panel data covering the years 2000 to 2017, focusing on China's assistance to recipients to examine the poverty reduction effects and mechanisms in the context of its aid to African countries. It assesses these aspects from three angles: poverty incidence, depth, and intensity. The primary findings of this research are as follows: First, the baseline regression analysis in this study clearly indicates that China's aid has a significant and lasting impact on reducing poverty incidence, depth, and intensity in recipient countries. This effect remains robust after conducting a series of sensitivity tests. Second, the mechanism analysis reveals that China's aid serves a dual role. On the one hand, its emphasis on economic infrastructure in African countries, such as transportation, energy, communication systems, and financial infrastructure, leads to capital accumulation and job creation, significantly contributing to poverty reduction in African nations.

On the other hand, China's aid in the form of social infrastructure, including education and healthcare, enhances human capital and substantially stimulates poverty reduction in African countries. Third, the heterogeneity analysis suggests that Official Development Assistance (ODA) has a more pronounced effect on reducing poverty intensity, while other forms of official assistance (OOF and VOF) are more effective in reducing poverty incidence. In terms of market-oriented assistance projects' impact on poverty reduction, mixed assistance is notably more effective in reducing poverty incidence. For poverty depth and intensity, development-oriented assistance has a more significant effect. This indicates that integrating market mechanisms into aid projects can encourage recipient countries to develop their self-reliant poverty reduction mechanisms. Moreover, considering the complexity of recipient countries' economic development and institutional quality, this paper employs per capita Gross National Income (GNI) and corruption levels to identify and test the heterogeneity in the poverty reduction effects of China's aid in recipient countries. The results show that China's aid has a more substantial impact on poverty reduction in countries with relatively lower per capita GNI and lower corruption levels.

Based on the aforementioned research findings, we propose the following policy recommendations:

Firstly, it is crucial to enhance collaboration between China and African countries in aid-driven poverty reduction. Capital accumulation, job creation, and human capital development are key mechanisms through which foreign aid can effectively facilitate poverty reduction in recipient countries. The Chinese government should continue to enhance its support for economic infrastructure in African countries, with a particular emphasis on areas such as transportation, energy, communication, and financial infrastructure. This will foster capital accumulation and job creation, thereby furthering poverty reduction in Africa. Additionally, the Chinese government should increase aid to African countries for social infrastructure, especially in the fields of education and healthcare, in order to enhance human capital and make substantial contributions to poverty reduction in African nations.

Secondly, there is a need to integrate market mechanisms into aid projects, with a focus on sustainability and the promotion of self-reliant poverty reduction mechanisms in recipient countries. For instance, China can provide increased support in technology transfer, talent development, and skills enhancement, thereby assisting recipient countries in improving their technical capabilities and fostering self-reliant development and poverty reduction. Furthermore, the Chinese government should enhance monitoring and evaluation in recipient countries by diligently collecting and analyzing the effects and impacts of aid projects in a timely manner. This will allow for adjustments and optimization of aid strategies and projects.

Thirdly, it is essential to promote the convergence of aid with trade and investment by facilitating trade between recipient countries and China, and encouraging Chinese enterprises to invest in African countries, particularly in infrastructure development, agriculture, and manufacturing. Moreover, China can explore opportunities for cooperation and co-building of demonstration zones in recipient countries. By introducing advanced Chinese technology, management expertise, and business models within these demonstration zones, China can stimulate industrial upgrading and economic development in recipient countries, ultimately achieving poverty reduction goals and fostering mutual benefits.

## Endnotes

1.The 48 recipient countries are Algeria, Angola, Benin, Botswana, Burundi, Cape Verde, Cameroon, Central African Republic, Chad, Comoros, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Djibouti, Egypt, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, South Africa, South Sudan, Sudan, Tanzania, Togo, Tunisia, Uganda, Zambia, Zimbabwe.



2.The World Bank's per capita Gross National Income (GNI) classification standards for the year 2010: Economies with a GNI less than \$1,005 are classified as low-income countries (or regions); Economies with a GNI ranging from \$1,006 to \$3,975 are categorized as lower-middle-income countries (or regions); Economies with a GNI ranging from \$3,976 to \$12,275 fall into the upper-middle-income countries (or regions) category; Economies with a GNI exceeding \$12,275 are considered high-income countries (or regions).

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