

Does the Small-Scale Trade in Border Areas Contribute to Poverty Reduction?

-- Evidence from China's border areas

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Abstract: With the vigorous development of strategies such as the "Belt and Road" Initiative, the Border Areas and Minorities Development Program, and the Western Development Program, China's border trade has flourished. Under the strong leadership of the Communist Party of China and the People's Government, China's poverty alleviation efforts have achieved remarkable results that have attracted worldwide attention, successfully eradicating the absolute poverty that has plagued the Chinese nation for many years. In this context, to investigate the impact of border trade on multidimensional poverty in border areas, this paper constructs a multidimensional poverty index from five dimensions: economy, healthcare, employment, education, and living conditions. A fixed-effects model is employed to empirically examine the impact of border trade on multidimensional poverty in border areas and its underlying mechanisms. The research findings are as follows: (1) Border trade significantly reduces the level of multidimensional poverty in border areas. This conclusion remains valid after conducting a series of robustness tests and using lagged variables as instrumental variables to address endogeneity issues. (2) Mechanism analysis reveals that border trade primarily improves multidimensional poverty through employment promotion effects, infrastructure effects, and fiscal expenditure effects. (3) Heterogeneity analysis shows that the poverty reduction effect of border trade is more pronounced in areas with lower population densities, lower urbanization rates, and in the southwestern and northwestern regions. This paper provides a new perspective for building common prosperity in the new era and offers academic support and policy guidance for further promoting border trade and strengthening friendly regional exchanges.

Keywords: Border trade activities, Border areas, Multidimensional poverty index, Common prosperity.

1. Introduction

From the gentle spring breeze of reform and opening-up to the brilliant chapter of the new era, China has made remarkable achievements in poverty reduction over the past 40 years, attracting worldwide attention. By the end of 2020, China had successfully helped 770 million rural poor people escape poverty and enter a moderately prosperous society in all respects. This magnificent feat not only demonstrates the firm determination and strong execution of the Chinese government but also contributes valuable experience and wisdom to the global poverty reduction cause. Through implementing a series of measures such as targeted poverty alleviation, industrial poverty alleviation, and education-based poverty alleviation, China has helped poverty-stricken areas and individuals achieve stable poverty eradication, making a positive contribution to building a community with a shared future for mankind and achieving common global development and prosperity. Although China has comprehensively eliminated absolute poverty, from a long-term and objective perspective, relative poverty will still exist. Most of China's relative poverty issues occur in the central and western regions, among which border areas lag behind due to harsh natural and climatic conditions, underdeveloped infrastructure, and inadequate talent pools. Solving the issue of relative poverty in border areas will not only help increase the income of border people, narrow the gap with the eastern regions, and accelerate the pace of achieving common prosperity but also significantly contribute to the high-quality

development of China's foreign trade.

Border trade between China and neighboring countries has accounted for more than a quarter of China's overall trade volume, serving as an essential channel for the exchange of goods and services. It is of great significance for enhancing the country's overall economic strength and promoting regional stability and development. Guangxi, China's gateway to Southeast Asian countries, conducts most of its foreign trade with the ten ASEAN countries, with 13 border crossings such as Dongxing, Pingxiang, and Youyiguan, ranking first in border trade nationwide. Yunnan borders Myanmar, Laos, and Vietnam, with a 4,061-kilometer borderline and eight national-level ports. Border trade in Yunnan has a history of over 2,000 years. Tibet, with its high altitude and harsh climatic conditions, has relatively less border trade volume among these regions. However, in recent years, with the introduction of the "Belt and Road" Initiative, Tibet's construction as a gateway to South Asia has significantly accelerated, with border trade volume increasing year by year. As a crucial node along China's "Belt and Road," Xinjiang serves as a vital gateway for northwest China, with a 5,600-kilometer border and famous ports such as Khorgos and Tuglat. Northeast China's border trade primarily involves North Korea, South Korea, and Japan. However, due to the slow economic development and low degree of opening-up in recent years, foreign trade in the region has been somewhat affected. In China's foreign trade, border trade occupies a prominent position, contributing not only to promoting the transformation and upgrading of economic development in border areas but also facilitating China's cooperation with

landlocked neighboring countries under the "Belt and Road" Initiative. Therefore, this paper takes border areas as the research object and analyzes the effect of border trade in eliminating regional overall poverty by establishing a comprehensive multidimensional poverty index.

2. Literature References

2.1. Research on Influencing Factors of Poverty Reduction

There are many factors influencing poverty reduction, and most of the existing literature focuses on two aspects: economic growth and income distribution. Economic growth serves as a crucial driving force for poverty reduction, while widening income gaps may undermine its effectiveness [1]. In rural poverty-stricken areas, the poverty reduction effect brought about by economic growth is more significant than that brought about by income distribution [2]. China's economy has achieved sustained and stable growth as a whole, providing a strong impetus for reducing multidimensional poverty. The overall income distribution situation in society has also contributed to further poverty reduction [3]. Meanwhile, numerous other factors also affect poverty levels. For instance, the rapid development of e-commerce in recent years has injected considerable momentum into reducing household multidimensional poverty [4], with rural e-commerce playing a vital role in the poverty reduction process. It not only increases the income of local poor farmers but also reduces transaction and living costs [5]. Education shapes the future, and talent cultivation plays an irreplaceable role in reducing local multidimensional poverty. The relationship between education quality and structure and the poverty reduction effect exhibits an "inverted U" shape, with the optimal poverty reduction effect achieved when the years of education reach around 12 [6]. In recent years, the core role of digital inclusive finance and financial literacy in poverty reduction has become increasingly prominent. By reducing the cost of financial services, it directly enhances residents' income and employment levels. Simultaneously, it indirectly promotes industrial structure upgrading and optimizes income distribution, thereby facilitating the poverty reduction process [7]. Government financial allocations can significantly reduce the incidence of poverty [8]. Since poverty is concentrated in rural areas, increasing social security expenditures in rural areas can effectively reduce poverty [9]. It is essential to give full play to the role of social security expenditures in regulating income distribution and supporting rural poverty alleviation.

2.2. Research on Border Trade

Most studies on border trade use provinces as research units, exploring the impact of regional partnerships on trade in border provinces. For example, the implementation of the RCEP has promoted the development of related industries in Guangxi, increased foreign trade volume, and enhanced Guangxi's economic strength and competitiveness [10]. The "Belt and Road" initiative has flourished in recent years, bringing unprecedented development opportunities to China's border areas and accelerating regional economic integration and prosperity. Xinjiang, with its unique geographical location, has leveraged the China-Europe freight train to deepen international cooperation in production capacity, providing strong support for the high-quality development of Xinjiang's foreign trade and port economy [11]. County-level

border trade in Yunnan Province is generally dominated by land border port economies and shows an upward trend in total border trade volume, but there are significant differences within the province [12]. Tibet is also a critical part of border trade research, with vibrant trade at the Naidula Border Trade Zone, Gyirong Port, and Purang Border Trade Zone [13]. Some literature also considers the entire region as the research background. Taking southwestern ethnic regions as an example, it shows that the scale of the risk of returning to poverty is the result of a complex interplay of multiple factors [14]. Economic scale and logistics performance index play an important intermediary role in border trade and are positively correlated with the scale of border trade [15]. Therefore, it is essential to accelerate the construction of transportation infrastructure and information and communication technology infrastructure.

2.3. Research on the Impact of Trade on Poverty Reduction

There are not many literature studies on the impact of trade on poverty reduction, which can be mainly divided into two factions. One faction believes that trade can increase national income and effectively alleviate poverty by promoting the development of labor-intensive industries, increasing employment opportunities, and raising the income level of unskilled workers. Trade liberalization can promote economic growth and increase the income of the poor, with the marginal effect of poverty reduction in inland areas being higher than that in coastal areas [16]. The impact of trade openness on poverty follows an inverted J-curve [17], meaning that after crossing a critical threshold, the higher the degree of trade openness, the more significant the poverty reduction effect. Trade openness has different effects on poverty reduction in urban and rural areas. Regions with stronger labor mobility experience greater reductions in income gaps, while the distortionary effects of the household registration system on the labor market hinder rural poor populations from enjoying trade dividends [18]. Analysis of the factors influencing poverty reduction effectiveness using the "conditional Markov model" found that countries with high trade openness are less prone to poverty recurrence than those with low trade openness and are more likely to transition from extreme poverty to moderate poverty [19]. Under high trade openness, reductions in trade barriers can lead to faster per capita income growth, bringing about income changes for the poor and reducing poverty. Under globalization, there is a strong positive correlation between trade volume and economic growth rates in poor countries, and poverty reduction is achieved through increased incomes among the poor [20]. The other faction argues that trade widens the gap between the rich and the poor, exacerbating social inequality [21], generating high adjustment costs, and not only failing to reduce poverty but deepening it. Those at the bottom of the income distribution become poorer with increased trade openness [22]. There is an inverted U-shaped relationship between trade openness and urban poverty, where in the initial stages of trade openness, increased openness leads to an increase in urban poverty, but as trade openness continues and reaches a certain threshold, it leads to a reduction in poverty [23].

Existing literature on multidimensional poverty reduction and border trade provides important ideas and insights for this paper, but there are still areas worth further exploration. Current literature focuses more on economic growth, income

distribution, digital inclusive finance, and special fiscal expenditures in poverty reduction. Research on border trade mainly concentrates on specific provinces, the "Belt and Road" initiative, or regional economic organizations, with few studies combining the two. Moreover, among articles that combine trade and poverty reduction, some scholars believe that trade has a positive impact on poverty reduction, while others disagree, arguing that foreign trade exacerbates income inequality and widens the gap between the rich and the poor. This paper opens up a new research perspective, taking border regions as the research object and exploring the impact of border trade on multidimensional poverty in these regions and its underlying mechanisms.

3. Theoretical Analysis and Research Hypotheses

This paper analyzes the transmission mechanism of the impact of border trade on multidimensional poverty mainly from three aspects: employment promotion effect, infrastructure effect [24, 25], and fiscal expenditure effect. For poverty reduction, we advocate more for the "blood-making" approach, emphasizing long-term and sustainable impacts.

3.1. Employment Promotion

The employment level is a crucial indicator for assessing the economic and social progress and development of a region. Especially in border areas, employment is the key to helping impoverished groups lift themselves out of poverty and become prosperous. As one of the fundamental ways to improve people's livelihoods, achieving stable employment plays a pivotal role in helping impoverished groups in border areas escape the trap of relative poverty. The thriving development of border trade can provide more job opportunities in border areas, which to a large extent helps alleviate the employment difficulties in these regions. By participating in border trade activities, impoverished groups can learn and master labor skills, thereby achieving stable employment and obtaining stable and sustainable sources of income. This not only effectively improves their living standards but also helps increase the per capita income level of the entire region, further alleviating poverty, reducing social contradictions, and promoting social harmony and stability.

Based on this, this paper proposes Hypothesis 1: Border trade has a significant effect on promoting employment in border areas, reducing the unemployment rate, and improving the poverty situation in these areas.

3.2. Infrastructure

In border areas, infrastructure construction is relatively inadequate. As a public good, it is characterized by large investment scales and low profit return rates, making it difficult for private capital to get involved. Therefore, it mainly relies on the entry of government capital. Well-developed infrastructure plays a vital role in improving trade conditions in border areas, helping to reduce trade costs, increase production efficiency, expand production scales, promote industrialization, and further drive the development of border trade.

Based on this, this paper proposes Hypothesis 2: The development of border trade is conducive to improving infrastructure construction, helping border areas break

through the infrastructure dilemma, consolidate the foundation for economic development, and promote a virtuous cycle.

3.3. Fiscal Expenditure

Border trade, as an important engine for promoting economic development in border areas, owes its significant poverty reduction effects to the strong support of fiscal expenditure. By increasing investment in infrastructure construction to optimize the trade environment, directly funding poverty alleviation projects to enhance the self-development capabilities of impoverished people, and optimizing resource allocation to improve utilization efficiency, fiscal expenditure ensures at the institutional level that border trade can fully unleash its potential, creating more employment opportunities and income sources for residents in border areas, thereby effectively supporting poverty reduction efforts.

Based on this, this paper proposes Hypothesis 3: The development of border trade can increase government fiscal expenditure, providing more resources to support the development of social undertakings, especially in the field of poverty reduction.

4. Research Design

4.1. Model Construction

To systematically study the impact of border trade on poverty reduction in border areas, this paper improves upon previous studies by scholars and constructs an econometric model:

$$Y_{i,t} = \beta_0 + \beta_1 \text{Intrade}_{i,t} + \beta_2 Z_{i,t} + \mu_i + \delta_t + \varepsilon_{i,t} \quad (1)$$

Where, $Y_{i,t}$ is the explained variable, representing the multidimensional poverty index of each region in each year; *trade* is the core explanatory variable of this paper, representing the annual border trade volume of each border area; $Z_{i,t}$ are the control variables, representing the degree of openness (opening), industrial structure (str), population density (pop), urbanization level (urb), and total area of the region (area), respectively; μ_i is the individual fixed effect, δ_t is the time fixed effect, $\varepsilon_{i,t}$ and is the error term.

4.2. Variable Names and Meanings

4.2.1. Explained Variable: Multidimensional Poverty Index

Unlike earlier approaches that considered economic income as the sole indicator of poverty, this paper follows the methodology of Chen Lizhong and Zhang Di [26] by constructing a multidimensional index to provide a detailed portrayal of poverty from five dimensions: economy, healthcare, employment, education, and living conditions. The economic dimension is represented by per capita income levels in border areas; the healthcare dimension is represented by per capita number of hospital beds in border areas; the employment dimension is represented by the number of people employed in the secondary and tertiary industries in border areas; the education dimension is represented by the number of students enrolled in primary and secondary schools; and the living conditions dimension is represented by the consumer price index. Data were selected from the statistical

yearbooks of various provinces and the China Education Statistical Yearbook spanning the period from 2002 to 2022.

In this paper, we have chosen the entropy weight method to calculate the weights of each indicator. As an objective weight allocation method, the entropy weight method determines the weight size based on the intrinsic characteristics and variation degree of the indicators themselves. This method can reduce the influence of subjective factors on weight judgments to a certain extent. The calculation formula is:

$$MPI = M_1 \times w_1 + M_2 \times w_2 + M_3 \times w_3 + M_4 \times w_4 + M_5 \times w_5 \quad (2)$$

Where, *MPI* represents the multidimensional poverty index, M_1, M_2, M_3, M_4, M_5 respectively represent the five dimensions of economy, healthcare, employment, education, and living conditions, and w_1, w_2, w_3, w_4, w_5 respectively represent the weights of each dimension, with calculated values of 0.3, 0.2, 0.2, 0.2, and 0.1, respectively.

4.2.2. Core Explanatory Variable: Border Small-scale Trade

Border trade takes two forms: border small-scale trade and border local trade. Firstly, border small-scale trade specifically refers to commercial transactions conducted by enterprises with operating rights in border areas (border counties (banners), and jurisdictions of border cities approved by the state for opening up along the land border) at specific border ports designated by the state, with enterprises or other trading organizations in neighboring countries' border areas. Secondly, the other form is bordering local trade, where the

main participants are residents of border areas, also known as border residents. Border residents can engage in border trade activities within a 20-kilometer area adjacent to China's land border. Since border small-scale trade accounts for over 70% of border trade volume, coupled with the availability of data, this paper selects border small-scale trade as the measure of border trade volume. Data spanning the period from 2002 to 2022 were obtained from customs statistics of various provinces.

4.2.3. Control Variables:

Industrial structure (*str*) is represented by the proportion of the value added of the secondary industry in GDP; population density (*pop*) is represented by the ratio of total population to total area; urbanization level (*urb*) is represented by the proportion of urban permanent residents in the total population; and the total area of the region (*area*) serves as a control variable; the degree of openness (*opening*) is represented by the ratio of total import and export value to regional GDP. Relevant data were obtained from the statistical yearbooks of various provinces.

4.2.4. Mechanism Variables:

Employment promotion effect (*epm*) is represented by the proportion of employed persons to the total labor force; infrastructure effect (*tel*) is represented by the ratio of telephone numbers to the total population in each region; fiscal expenditure effect (*gov*) is represented by the proportion of local fiscal expenditure to GDP. Data were obtained from the statistical yearbooks of various provinces.

Table 1. Variable Names and Descriptive Statistics

Variable		Sample Size	Mean	Standard Error	Max	Min
Explained Variable	MPI	438	0.61	0.22	0.84	0.39
Core Explanatory Variable	Intrade	438	21.99	1.81	25.73	15.65
Control Variables	opening	438	0.147	0.086	0.427	0.011
	str	438	40.09	7.41	56.30	20.19
	pop	438	48.98	13.29	78.64	20.85
	urb	438	0.35	0.32	1.33	0.11
	area	438	68.91	54.28	166.49	14.86
Mechanism Variables	gov	438	106.89	94.40	294.68	2.18
	emp	438	7.168	0.854	7.985	4.869
	tel	438	4.368	0.490	4.973	2.572

5. Empirical Test and Result Analysis

5.1. Benchmark Regression

To preliminarily investigate the multidimensional poverty reduction effect of border trade in border areas, this paper first conducts a benchmark regression using a fixed-effects model, and to ensure the robustness of the data, the explanatory variables are treated with natural logarithms. As shown in Table 2, the linear relationship between border trade and

multidimensional poverty is positively correlated, with an improvement of 0.029% in multidimensional poverty for every 1% increase in border trade volume. This positive relationship remains robust in the regressions of columns (1) to (6) as control variables are gradually added, and all pass the 1% significance level test. This indicates that border trade has a significant multidimensional poverty reduction effect in border areas, providing a strong impetus for all-round development in border regions and improving the living conditions of people in border areas.

Table 2. Baseline Regression Results

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Intrade	0.027***	0.028***	0.028***	0.027***	0.031***	0.029***
	(3.99)	(5.10)	(5.08)	(5.26)	(5.90)	(5.28)
urb		0.007***	0.007***	0.005***	0.005***	0.005***
		(9.72)	(9.16)	(6.24)	(5.93)	(5.93)
str			0.000	-0.003*	-0.003*	-0.003*
			(0.19)	(-1.82)	(-1.87)	(-1.88)
opening				-0.172***	-0.133***	-0.135***
				(-4.24)	(-3.13)	(-3.18)
pop					0.001***	0.002**
					(2.77)	(2.39)
area						0.001
						(0.83)
constant term	0.009	-0.355***	-0.363***	-0.085	-0.201	-0.196
	(0.06)	(-2.83)	(-2.74)	(-0.59)	(-1.38)	(-1.34)
urban effect	YES	YES	YES	YES	YES	YES
time effect	YES	YES	YES	YES	YES	YES
N	438	438	438	438	438	438
R ²	0.088	0.421	0.421	0.479	0.503	0.505

Note: ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. The values in parentheses are t-values. The same applies to the following tables.

5.2. Heterogeneity Analysis

Based on the benchmark regression results discussed earlier, we can conclude that border trade is conducive to

alleviating multidimensional poverty in border areas. However, this analysis is a conclusion drawn from an overall perspective without considering the differences among various regions. Therefore, a heterogeneity test will be conducted below based on differences in population density, urbanization rate, and regional differences.

Table 3. Results of Heterogeneity Analysis by Population Density.

Variable	(1)	(2)	(3)	(4)
	High population density		Low population density	
Intrade	0.122***	0.035***	0.066***	0.070***
	(7.68)	(4.50)	(5.36)	(8.92)
urb		0.027***		0.015***
		(17.62)		(18.10)
str		0.013***		0.001
		(3.53)		(0.98)
opening		-1.297***		-0.186
		(-4.97)		(-1.20)
pop		0.006***		-0.004***
		(11.95)		(-4.06)
area		0.042***		-0.001
		(16.11)		(-1.52)
constant term	-2.072***	-3.920***	-0.871***	-1.459***
	(-6.02)	(-11.43)	(-3.13)	(-11.11)
urban effect	YES	YES	YES	YES
time effect	YES	YES	YES	YES
N	219	219	219	219
R ²	0.596	0.971	0.260	0.915

In this paper, we divide regions based on the median population density into areas with higher population density and areas with lower population density. As shown in Table 3, the regression coefficients are significant at the 1% level in both areas with higher and lower population densities, indicating that border trade has an improvement effect on multidimensional poverty in both types of areas. In columns (2) and (4), the improvement effect is greater in areas with lower population density than in areas with higher population

density. This may be because areas with lower population density tend to have relatively less resource allocation and competitive pressure, allowing economic opportunities and benefits brought by border trade to directly and evenly benefit local residents. Additionally, these areas often possess richer natural resources and unique geographical advantages, such as border crossings and convenient transportation, which provide favorable conditions for border trade, further promoting local economic development and reducing poverty.

Table 4. Results of Heterogeneity Analysis by Urbanization.

Variable	(1)	(2)	(3)	(4)
	High urbanization rate		Low urbanization rate	
Intrade	0.091*** (4.79)	0.009 (1.17)	0.125*** (9.39)	0.035*** (4.52)
urb		0.002 (0.62)		0.026*** (16.91)
str		-0.001 (-0.64)		0.013*** (3.48)
opening		0.151 (0.68)		-1.302*** (-5.01)
pop		0.005*** (9.75)		0.006*** (12.18)
area		0.054*** (9.47)		0.042*** (16.18)
constant term	-1.353*** (-3.34)	-1.716*** (-5.98)	-3.987*** (-7.60)	-3.873*** (-11.33)
urban effect	YES	YES	YES	YES
time effect	YES	YES	YES	YES
N	219	219	219	219
R ²	0.370	0.984	0.756	0.970

Based on the median urbanization rate, regions are divided into those with higher urbanization rates and those with lower urbanization rates. As shown in Table 4, before adding control variables, the mitigation effect of border trade on multidimensional poverty in regions with higher urbanization rates is significant, but it becomes insignificant after adding control variables. This may be because the control variables include other important factors that affect multidimensional poverty. For example, factors such as education level, industrial structure, and policy support may have more complex and profound impacts on poverty. When these factors are included in the analysis framework, the direct impact of border trade on multidimensional poverty may be partially or completely offset. In addition, regions with higher urbanization rates may face unique challenges, such as urban problems (e.g., traffic congestion, environmental pollution, housing shortages), and increased social inequality, which may weaken the mitigation effect of border trade on multidimensional poverty. In columns (3) and (4), we can see that regardless of whether control variables are added, the mitigation effect of border trade on multidimensional poverty in regions with lower urbanization rates is significant. This may be because regions with lower urbanization rates can more effectively utilize their resources and geographical advantages in border trade, directly benefiting from the economic opportunities and income increases brought about by trade activities, thereby significantly reducing multidimensional poverty.

Based on geographical differences, border areas are divided into southwestern, northwestern, and northeastern regions. As shown in Table 5, the multidimensional poverty reduction effect in southwestern regions is significant at the 1% level, with the largest coefficient. This may be due to the advantageous geographical location of Guangxi and Yunnan, which are close to ASEAN and have long borderlines. Trade exchanges with neighboring countries are more convenient. Yunnan borders Vietnam, Laos, and Myanmar, while Guangxi shares a land border with Vietnam. These countries are important members of ASEAN, providing a vast market for border trade. The multidimensional poverty reduction effect in the northwestern region is also significant, but it is slightly smaller than that in the southwestern region, possibly because the northwestern borderlines connect with West Asian

countries with weaker economic foundations. The poverty reduction effect in the northeastern region is not significant, which may be attributed to the smaller scale of border trade in this region and the influence of certain political factors. When conducting trade cooperation with North Korea and Russia, considerations must be given to the country's political and economic security, especially the special political environment in North Korea, which affects the depth of economic and trade cooperation between the two sides. Additionally, the products exported from the northeastern region are mostly primary processed products and labor-intensive products, making the border trade in this region relatively weak in terms of added value and competitiveness.

Table 5. Results of Regional Heterogeneity Analysis.

Variable	(1)	(2)	(3)
	southwest	northwest	northeast
Intrade	0.094*** (4.56)	0.050*** (2.91)	0.001 (0.14)
urb	0.002 (0.79)	0.008*** (4.32)	0.010*** (4.46)
str	0.008 (0.99)	0.005 (1.62)	-0.001 (-0.39)
opening	-1.635** (-2.08)	-0.481 (-1.55)	-0.140 (-0.62)
pop	-0.001* (-2.00)	-0.000 (-0.54)	0.001* (1.77)
area	-0.006*** (-5.65)	0.001 (0.67)	0.001 (0.58)
constant term	-1.219* (-2.00)	-1.168*** (-4.41)	-0.089 (-0.47)
urban effect	YES	YES	YES
time effect	YES	YES	YES
N	196	154	88
R ²	0.674	0.732	0.681

5.3. Robustness Tests

Border trade can be influenced by regional poverty situations or other political and economic factors. To eliminate the potential impact of endogeneity issues on the results, this paper selects the first-order lagged term of border trade volume as an instrumental variable and re-conducts a two-stage least squares regression analysis based on this. This method aims to capture the dynamic effects of border trade by

introducing lagged terms and reduce potential endogeneity issues, thereby enhancing the reliability and accuracy of the regression results. The first-order lagged term of border trade volume, as an instrumental variable, embodies both relevance—the trade volume in the previous period affects the current period—and exogeneity—it avoids the endogeneity problem of bidirectional causality with the current poverty status. As shown in column (1) of Table 4, the coefficient is significant at the 1% level, and the corresponding sign does not change, indicating that endogeneity issues have little impact on the benchmark regression results, and the poverty reduction effect of border trade development in border areas exists.

To exclude the potential influence of the COVID-19 pandemic, the sample values from 2020 to 2022 are removed, and the model is regressed again while controlling for corresponding control variables. The sample data from 2020 to 2022 are excluded because during this period, China's border foreign trade was affected by the COVID-19 pandemic. Many ports strengthened epidemic prevention and control measures and restricted passenger flows, resulting in cargo delays, increased trade costs, impeded business personnel exchanges, and reduced border trade volume. Therefore, these three years' samples are excluded. As shown in column (2), the coefficients are all significant at the 1% level, indicating that excluding these three years' samples has no adverse effects on the results. The method of excluding sample values from 2020 to 2022 does not change the poverty reduction effect of border trade on border areas, and the final conclusion is robust.

To avoid the potential influence of outliers on the regression results, the sample variables are now subjected to a Winsorization process. As shown in column (3) of Table 6, the coefficients and significance do not change significantly, indicating that after Winsorization, the multidimensional poverty reduction effect of border trade on border areas still exists, and the results are robust.

Table 6. Results of Robustness Checks.

Variable	(1)	(2)	(3)
	lagged by one period	exclude sample values from 2020 to 2022	winsorization
Intrade	0.026*** (4.98)	0.029*** (5.28)	0.039*** (7.87)
urb	0.005*** (6.64)	0.005*** (5.93)	0.007*** (10.57)
str	-0.004*** (-2.82)	-0.003* (-1.88)	0.001 (0.45)
opening	-0.140*** (-3.58)	-0.135*** (-3.18)	-0.632*** (-4.40)
pop	0.001*** (3.45)	0.000** (2.39)	0.001*** (5.62)
area	0.001 (1.59)	0.001 (0.83)	0.001*** (3.58)
constant term	-0.111 (-0.80)	-0.196 (-1.34)	-0.710*** (-5.91)
urban effect	YES	YES	YES
time effect	YES	YES	YES
N	417	378	421
R ²	0.583	0.505	0.640

5.4. Mechanism Analysis

The previous analysis indicates that border trade significantly promotes the multidimensional poverty

reduction effect in border areas. Based on the mechanism hypothesis, this paper will explore the pathways through which the aforementioned poverty reduction effect occurs from the following aspects. The model setup is as follows:

$$MED_{i,t} = \beta_0 + \beta_1 Intrade_{i,t} + \beta_2 Z_{i,t} + \mu_i + \delta_t + \varepsilon_{i,t} \quad (3)$$

Where, $MED_{i,t}$ is the mechanism variable, and the other variables are the same as above. According to the mechanism analysis in the previous sections, this paper empirically tests the effects of employment promotion, infrastructure, and fiscal expenditure.

Table 7. Results of Mechanism Analysis.

Variable	(1)	(2)	(3)
	employment promotion	infrastructure	fiscal expenditure
Intrade	0.114*** (8.35)	0.172*** (6.99)	0.022** (2.58)
pop	-0.023*** (-5.52)	-0.028*** (-3.82)	0.014*** (5.42)
str	-0.004* (-1.73)	0.012** (2.56)	0.007*** (4.20)
urb	0.019*** (8.17)	0.022*** (5.22)	-0.006*** (-4.00)
Opening	1.827*** (6.26)	2.720*** (5.13)	0.015 (0.08)
area	0.025*** (4.37)	0.029*** (2.85)	0.038*** (10.68)
constant term	0.687 (1.21)	-0.811 (-0.79)	11.061*** (30.87)
urban effect	YES	YES	YES
time effect	YES	YES	YES
N	438	438	438
R ²	0.815	0.676	0.842

Table 7 reports the overall effects of the mechanism through which border trade influences multidimensional poverty. The employment promotion effect is shown in column (1), with a significantly positive estimated coefficient, indicating that border trade has significantly improved local employment levels. The vigorous development of border trade has had a positive impact on the local economy, increasing job opportunities, providing more work positions for local residents, giving them stable jobs, and improving their living conditions. Column (2) represents the infrastructure effect, with a significantly positive coefficient, indicating that border trade has promoted local infrastructure construction. The development of border trade has driven the development of trade infrastructure, making trade conditions more convenient and reducing trade costs. Column (3) represents the fiscal expenditure effect, with a coefficient of 0.022, which is significantly positive. By optimizing the fiscal expenditure structure, the government can utilize the economic vitality brought by border trade to increase investment in infrastructure construction, education, healthcare, and public services in poverty-stricken areas. These investments not only directly improve local production and living conditions, raise residents' income levels, but also promote the formation and accumulation of human capital, enhancing the self-development capabilities of poverty-stricken areas, thereby effectively advancing the poverty reduction process.

Overall, the impact of border trade on multidimensional

poverty in border areas exerts its poverty reduction effect through three channels: employment promotion, infrastructure, and fiscal expenditure effects. Therefore, hypotheses one, two, and three of this paper are validated.

6. Research Conclusions and Policy Implications

Based on panel data from border areas from 2002 to 2022, this paper uses a fixed-effects model to empirically examine the poverty reduction effects and mechanisms of border trade on multidimensional poverty in border areas from five dimensions: economy, healthcare, employment, education, and living conditions. It also analyzes the mechanisms through which border trade influences poverty reduction in border areas from both theoretical and empirical perspectives. The conclusions of this paper are as follows:

First, border trade significantly improves multidimensional poverty in border areas, and the results remain robust after excluding sample sizes and using the lagged term of explanatory variables as instrumental variables to address endogeneity issues. Second, the poverty reduction effect of border trade is more pronounced in border areas with lower population densities and urbanization rates, as well as in southwestern and northwestern regions. Third, the poverty reduction effect of border trade on multidimensional poverty in border areas is achieved through employment promotion, infrastructure, and fiscal expenditure effects.

Based on the above conclusions, the policy implications of this paper are:

First, alleviate multidimensional poverty through enhancing the depth and breadth of border trade, strengthening intensive cooperation in border trade, deepening trade relations with neighboring countries, supporting the development of key industries, and guiding enterprises to optimize the export product structure, focusing on high-tech and high value-added products. At the same time, actively expand new trade markets, implement diversified market strategies, strengthen international exchanges and cooperation, and cultivate emerging industries and specialty products, especially agricultural exports, to enhance their competitiveness on the international stage through continuous innovation and optimization.

Second, promote coordinated development among areas with high and low urbanization rates, high and low population densities, southwestern, northwestern, and northeastern regions, and construct an equalized and shareable border trade system to ensure optimal allocation of resources and complementary economic development. Strengthen inter-regional talent mobility and training, promote the sharing of knowledge, skills, and experience, and provide strong talent support for economic and social development in various regions.

Third, actively promote the coordinated development and organic integration of border trade with policies such as the Western Development Program, the Belt and Road Initiative, and targeted poverty alleviation. Through strengthened policy communication and collaboration, achieve resource sharing and complementary advantages, and promote economic prosperity and improved living standards in border areas. At the same time, leverage the strategic opportunities of the Western Development Program to drive infrastructure construction and social development in border areas; integrate the Belt and Road Initiative to expand the space for foreign

trade cooperation and enhance the level of open economic development; and adhere to the principle of targeted poverty alleviation to ensure that the poor in border areas are lifted out of poverty and achieve common prosperity.

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