Reducing poverty in India: the impact of global and local structural factors

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Received 13 March 2024
Revised 22 June 2024
23 September 2024
18 November 2024
Accepted 22 December 2024

Abstract

Purpose – This study aims to examine the influence of global and local structural factors on reducing poverty.

Design/methodology/approach – The research uses data spanning from 1996–2022 and uses the nonlinear autoregressive distributed lag model. This model allows for the assessment of the short and long-term effects of remittance inflow (RI) growth, control on corruption and employment rate (ER) on poverty reduction in India.

Findings – The research findings indicate that in the short run, an increase in international RIs, a higher control of corruption and a greater ERare associated with a decrease in poverty in India. Specifically, a positive change in RIs and control of corruption significantly reduces poverty, while an increase in the ERhas a substantial impact. However, in the long run, only a positive change in RIs and a higher control of corruption continue to significantly reduce poverty.

Originality/value – This study makes several significant contributions to the existing literature. First, it examines the simultaneous impact of three structural factors on poverty, offering insights into their combined long-term effects on the economy. Second, unlike previous studies, this research investigates the nonlinear effects on poverty, which is particularly relevant for developing nations. Lastly, this study aligns with the United Nations' Sustainable Development Goal 1, which aims to end poverty in all its forms everywhere. The findings of this study are expected to assist Indian policymakers in formulating effective poverty eradication strategies and provide guidance for other developing nations facing similar challenges.

Keywords Remittances, Corruption, Employment, Poverty, India, Sustainability

Paper type Research paper

1. Introduction

Being labeled as poor is universally undesirable, whether one resides in a highly developed nation, a developing country, an area plagued by famine or a nation in conflict. Individuals grappling with poverty confront a multitude of challenges in their daily lives. There are primarily three dimensions through which poverty impacts an individual. First, those experiencing poverty often find it challenging to fulfill their basic daily necessities (Morris *et al.*, 2020). Second, poverty can result in a feeling of disconnection from society, affecting one's self-respect and dignity, thereby hindering personal growth and development (Spicker, 2020). Third, the repercussions of poverty

JEL classification – E24, F24, J13, Q01

The authors confirm that they did not receive any financial assistance or grants for the creation or dissemination of this research paper.

Funding disclosure: The authors affirm that they did not receive financial backing for the inception, authorship or dissemination of this article.

Conflict of interest: The authors declare the absence of any discernible conflicts of interest pertinent to this research publication.

Data availability statement: The data sets used and scrutinized in this study are accessible upon a reasonable request directed to the corresponding author.

Indian Growth and Development Review
Vol. 18 No. 1, 2025
pp. 20-41

1753-8254
DOI 10.1108/IGDR-03-2024-0031

can extend to future generations, as individuals in poverty may encounter difficulties in providing their children with adequate education and a high quality of life (Magnuson and Duncan, 2019).

Currently, the global population is approximately 8 billion, with 719 million people, accounting for 9.2% of the world's population, living on less than $2.15 per day (World Vision, 2022). Of particular concern is the disproportionate burden borne by children and youth, who constitute two-thirds of the impoverished population, alongside women who are the majority in most regions. Moreover, an estimated 1.9 billion individuals, equivalent to 24% of the global population, reside in fragile environments marked by impoverished conditions and severe circumstances. Projections suggest that by 2030, more than half of the world's impoverished will inhabit such precarious contexts, presenting substantial obstacles to poverty alleviation endeavors. Furthermore, a significant proportion of individuals older than 15 living in extreme poverty, about 63%, possess minimal to no formal education, restricting their prospects for economic progress and perpetuating the poverty cycle. Additionally, multidimensional poverty afflicts 1.2 billion individuals in 111 developing nations, constituting 19% of the global population (UN, 2022).

The aforementioned statistics paint a grim picture of world poverty. However, they also motivate us to address these poverty-related concerns, which can yield numerous benefits extending far beyond economic prosperity. Socially, addressing poverty can foster greater equality and inclusivity, reducing social tensions and promoting a more cohesive society (Brown and James, 2020). Economically, it can stimulate growth by expanding the consumer base, fostering innovation and creating a more stable and productive workforce (Werhane *et al.*, 2020). On the fronts of health and education, eradicating poverty can lead to a healthier and more skilled population, which can be an asset for a country. Health is a critical determinant of economic productivity and poverty reduction. Poor health can lead to reduced labor market participation and lower earnings, perpetuating the cycle of poverty (Bloom *et al.*, 2001). Investments in healthcare, such as improved access to medical services, preventive measures and health education, can enhance physical and mental health, thereby increasing an individual's ability to work and earn a stable income (WHO, 2010). Empirical evidence suggests that better health outcomes are associated with significant reductions in poverty levels (Deaton, 2003). Similarly, education plays a vital role in enhancing skills, knowledge and competencies, making individuals more competitive in the labor market and increasing their earning potential (Psacharopoulos and Patrinos, 2004). Higher education levels correlate with better employment opportunities and job stability, which are pivotal in lifting individuals out of poverty (UNESCO, 2015). Education also contributes to better health outcomes, informed decision-making and overall quality of life, creating a positive feedback loop in combating poverty (Glewwe, 1999). Studies have shown that educational attainment significantly reduces poverty levels, supporting the argument for substantial investments in education as part of poverty alleviation strategies (Tilak, 2002). Additionally, poverty eradication can lead to a more sustainable use of resources and a more resilient economy as marginalized populations become more economically active and less dependent on aid (Scheyvens and Momsen, 2020).

Acknowledging the benefits associated with poverty eradication, notable global advancements have been achieved in recent decades. For example, the proportion of people living in extreme poverty (defined as living on less than $2.15 a day) has declined dramatically, from nearly 43% of the global population in 1981 to about 9% in 2019 (World Bank, 2022a). However, despite significant progress, several challenges persist in the global effort to eradicate poverty (Khan and Gunwant, 2024). One major challenge is the concentration of extreme poverty in certain regions, particularly sub-Saharan Africa and South Asia (Olaoye *et al.*, 2023). Additionally, income inequality within and between

countries continues to hinder progress, as the benefits of economic growth often fail to reach the poorest segments of society (Khan, 2024a). Furthermore, access to basic services such as education, healthcare and clean water remains inadequate for many, particularly in rural and marginalized communities. While these challenges to poverty eradication exist globally, they are especially acute in developing nations, where limited resources can constrain effective responses (Leal Filho *et al.*, 2021).

One such developing country is India, which has long struggled with poverty. By the end of 2022, approximately 11% of the Indian population, equivalent to 176 million people, lived below the poverty line on $2.15 a day (World Bank, 2022b). Several factors contribute to this significant level of poverty. First, India's immense population of 1.4 billion people poses a major challenge to poverty eradication efforts (Bathla *et al.*, 2020). Development across its diverse states and regions occurs unevenly, further complicating the situation. Second, structural challenges typical of a developing country, such as inadequate infrastructure, limited access to education and healthcare and high levels of informal employment, perpetuate the cycle of poverty (Garrity and Martin, 2018). These conditions limit opportunities for economic and social advancement. Third, limited financial resources often hinder the implementation of effective poverty reduction programs. Additional obstacles like corruption, bureaucratic inefficiency and a lack of political will can impede policymaking and progress (Khan, 2024b). Finally, external shocks such as economic downturns, natural disasters and pandemics have the power to worsen existing poverty and reverse any gains previously made toward its reduction.

Even though these poverty eradicating challenges exists, the Indian government has shown a steadfast commitment to improving citizens' well-being despite persistent poverty challenges. Initiatives like the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) guarantee 100 days of wage employment to rural households, enhancing livelihood security and contributing to rural development (Ravichandran, 2023). Other programs, such as the National Rural Livelihood Mission and the National Urban Livelihood Mission, provide sustainable livelihood opportunities to the rural and urban poor (Verma and Mani, 2020). The Pradhan Mantri Awaas Yojana focuses on affordable housing for the urban poor, while the Deen Dayal Upadhyaya Antyodaya Yojana emphasizes skill development for urban poor (Khare, 2022). Social security schemes like the National Social Assistance Programme and the Pradhan Mantri Jan Dhan Yojana provide financial assistance and banking services to the poor (Patni, 2023). The Direct Benefit Transfer scheme transfers subsidies directly to beneficiaries' bank accounts, reducing leakages and improving welfare targeting (Dar *et al.*, 2022).

Despite commendable efforts, eradicating poverty in India remains challenging due to several factors. The large and diverse population, especially in rural areas, faces limited access to basic services like education and healthcare (Tilak, 2018). Income inequality between urban and rural areas, as well as between states, worsens poverty rates. Poor access to quality education and healthcare in rural areas hampers upward mobility, while informal employment and lack of formal job opportunities keep many in poverty. Inadequate infrastructure, such as poor roads and lack of electricity and clean water, further hinder economic development (Shrestha, 2021). Corruption, bureaucratic inefficiency and uneven policy implementation also impede poverty reduction efforts. Climate change adds to these challenges, particularly affecting rural communities reliant on agriculture. Addressing these issues requires promoting inclusive growth, improving access to services and strengthening governance. But the question arises:

Q1. What are those factors that help India reduce its poverty level?

To address the aforementioned question, several key factors have garnered global attention in the past two decades. First, foreign fund inflows in the form of remittances have emerged as a significant factor in fulfilling the financing requirements for eradicating poverty. Remittances, particularly from abroad, serve as a stable source of income for many families, lifting them out of poverty and contributing to local economic development. This trend is particularly pronounced in India, which receives the highest remittance inflows (RIs) in the world, amounting to $125bn by the end of 2023 (World Bank, 2023b). By bolstering household income, remittances can enhance access to education, healthcare and other essential services crucial for poverty alleviation. Second, the prevalence of corruption at various levels in developing nations has been identified as a significant hindrance to economic development and the effective implementation of government policies. As of the end of 2022, India ranked 44th globally in the Control of Corruption: Percentile Rank, indicating a pressing need to address corruption issues (World Bank, 2023a). By curbing corruption, governments can ensure that resources reach those in need, thereby enhancing the effectiveness of poverty alleviation programs. Third, the improvement of the employment-to-population ratio represents another crucial factor. A higher ratio signifies increased economic activity, leading to more job opportunities and higher income levels for the population. As of the end of 2022, India's employment-to-population ratio stood at 49.82%, ranking 142nd out of 219 countries globally (World Economics, 2024). This indicates a need for substantial efforts to improve the country's employment rate (ER). Enhancing employment opportunities can reduce the poverty headcount ratio, as more individuals are able to earn a sustainable income. Moreover, higher employment levels can drive increased consumption, investment and overall economic growth, fostering a cycle of prosperity that can further diminish poverty rates.

Thus, a research project analyzing the interaction between RIs, the decrease in corruption and the ER can provide valuable insights into the factors influencing poverty reduction in India. These are those crucial structural variables that can significantly affect the economic well-being of individuals and households. Furthermore, it will not only enhance our understanding of poverty dynamics but also offer evidence-based guidance for policymakers, educators and researchers in formulating strategies and policies aimed at poverty alleviation and sustainable development in India. Hence, the research questions of this study are as follows:

RQ1. Does remittance inflow help India reduce poverty?

RQ2. Does the control of corruption help India reduce poverty?

RQ3. Does the employment rate help India reduce poverty?

Furthermore, while existing literature may extensively documents the positive impacts of RIs, corruption control and employment on poverty reduction across various countries, there are significant gaps exists that this study aims to address. First, the context of India, with its unique socio-economic landscape and diverse demographic profile, has not been comprehensively studied in the context of these variables. Second, previous studies primarily focus on linear relationships, whereas my research employs the Nonlinear Autoregressive Distributed Lag (NARDL) model to capture potential nonlinear effects, offering a more nuanced understanding of these dynamics. This methodological approach allows for the examination of both short-term and long-term relationships, as well as the asymmetric effects of the variables on poverty. By focusing on the period from 1996 to 2022 and using robust time series data, my study provides fresh insights into the interplay between RIs, corruption control, employment and poverty reduction in India. These unique aspects contribute to the originality of the research and offer

significant implications for policymakers aiming to achieve sustainable development goals (SDGs).

The subsequent portion of the investigation is outlined as follows: Section 2 of the study highlights the theoretical underpinnings and literature review pertaining to the topic. Section 3 provides a comprehensive exposition of the data and methodology employed in the study. Section 4 of the document encompasses the presentation and analysis of the obtained results, followed by a comprehensive discussion of the findings. Section 5 of the study encompasses the conclusion, recommendation and policy implications. Finally, the research paper concludes with a discussion of the limitations of the study and provides suggestions for future research endeavors.

2. Theoretical background

Jeffrey Sachs, in his seminal book, "The End of Poverty: How We Can Make It Happen in Our Lifetime" provides a compelling framework for understanding the interplay between economic and institutional factors in perpetuating poverty, particularly in developing countries. His work posits that weak institutions, characterized by corruption and inefficiency, create a vicious cycle that hinders economic growth and perpetuates poverty (Sachs, 2005a). Sachs argues that in such environments, breaking free from poverty becomes increasingly difficult as these weak institutions create barriers to economic opportunities and innovation (Sachs, 2005b). Incorporating RIs, control on corruption and the ER into this theory, we can imagine a scenario where a significant portion of the population in a developing country relies on remittances from family members working abroad. While these remittances provide a crucial source of income, they may not be sufficient to lift families out of poverty due to high levels of corruption and inefficiency in local institutions. Corruption, for instance, can divert a substantial portion of remittance funds, diminishing their impact on poverty alleviation. Moreover, a low ER, partly stemming from the challenges of conducting business in a corrupt and bureaucratic environment, can result in elevated levels of unemployment and underemployment, further exacerbating poverty.

However, the applicability of Sachs theory to poverty reduction efforts in India warrants consideration. India, as a developing country, faces similar challenges with weak institutions, corruption and high poverty levels. While the theory provides valuable insights, its effectiveness in the Indian context may depend on various factors, including the specific nature of institutional weaknesses and the country's capacity for implementing meaningful reforms. Therefore, further research and analysis are needed to determine the extent to which Sachs theory can inform strategies for reducing poverty in India.

2.1 Literature review

Poverty is a complex and widespread problem impacting people globally, characterized by inadequate access to essentials like food, shelter, education and healthcare. It creates a cycle of deprivation, particularly challenging for those born into poverty due to limited opportunities and resources. One major contributor to poverty is the lack of financial resources, with RIs standing out as a significant factor due to their consistent growth over the past three decades, transcending national borders. Therefore, it is crucial to understand the impact of RIs on poverty eradication through existing literature. Taking this argument into account, Masron and Subramaniam (2018) conducted a study covering 44 developing countries from 2006 to 2014 and found strong evidence that higher levels of remittances are associated with lower poverty rates. This suggests that remittances play a crucial role in reducing poverty by increasing household incomes and supporting more productive activities. Similarly, Azizi (2021) studied 103 developing countries from 1990 to 2014, using

bilateral remittances as instruments to address endogeneity issues. The results indicated that a 10% increase in per capita remittances led to a 1% decrease in poverty headcount, a 1.8% decrease in poverty gap and a 2.5% decrease in poverty headcount.

Peković (2017) focused on nine transition economies from 2002 to 2013 and found that a 10% increase in remittances per capita was associated with average declines of 4.7%, 5.2% and 5.8% in poverty headcount, poverty depth and poverty severity, respectively. These findings highlight the significant impact of remittances on poverty reduction in transition economies. Mehedintu *et al.* (2019) studied nine emerging countries in the European Union from 2005 to 2017 and found that while remittances and the risk of poverty threshold were influenced by the global economic crisis, remittance trends varied among countries. In Bangladesh, Kumar (2019) analyzed data from 216 households and found that households receiving remittances had significantly lower poverty levels compared to those not receiving remittances. Receiving remittances reduced the probability of a household being poor by 28.07%, indicating a strong positive impact on poverty alleviation. Ekanayake and Moslares (2020) studied 21 Latin American countries from 1980 to 2018 and found that workers' remittances had a positive long-run effect on economic growth and helped reduce poverty rates in the region. Musakwa and Odhiambo (2019) studied Botswana from 1980 to 2017 and found that RIs reduced poverty in the country, especially when using infant mortality rate as a proxy. Abduvaliev and Bustillo (2020) focused on the Commonwealth of Independent States and found that a 1% increase in remittance flows led to a 0.25% increase in per capita GDP and a 2% decrease in poverty severity.

Furthermore, Musakwa and Odhiambo (2020) studied South Africa from 1980 to 2017 and found that remittances negatively impacted poverty when using household consumption expenditure as a proxy but had no impact when using infant mortality rate. In Punjab, Pakistan, Imran *et al.* (2020) found that foreign remittances reduced both the incidence and severity of poverty across all three regions of Punjab. Arapi-Gjini *et al.* (2020) studied Kosovo and found that remittances reduced absolute and relative poverty levels, although they also indicated a marginal increase in inequality. Khan (2023) focused on South Asia and found that remittances significantly reduced poverty both in the short and long run, despite potential hindrances from inflation and trade openness. Finally, Butkus *et al.* (2020) studied Central and Eastern European countries and found that remittances significantly impacted three out of four poverty measures, indicating their crucial role in poverty reduction in these countries.

From the aforementioned literature review, three main findings emerge. First, studies on remittances predominantly highlight their positive impact on poverty reduction. Second, the majority of the studies have analyzed linear effects of remittances, while nonlinear effects have received less attention in the literature. Third, there is no comprehensive study available on the context of India.

Transitioning to our next focus, corruption, which remains a challenge in numerous nations, plays a pivotal role in the fight against poverty. A study on South Africa showed that globalization has a positive impact on poverty reduction, likely due to increased economic growth, employment opportunities and higher incomes for the poor. However, corruption can dampen or reverse these positive effects, highlighting the importance of addressing corruption to maximize the benefits of globalization in reducing poverty (Salahuddin *et al.*, 2020). In the context of the South Asian Association for Regional Cooperation (SAARC) countries, a study on capability poverty, as measured by the Human Development Index, found that reduced corruption and increased women's labor force participation are linked to poverty reduction and improved social welfare. The analysis, using panel data and the panel autoregressive distributed lag (ARDL) model, emphasizes the significance of governance

and gender-inclusive policies in poverty alleviation efforts (Vinayagathasan and Ramesh, 2022).

Turning to Southeast Asia, particularly ASEAN countries, another study examined the causal impacts of corruption on economic and social development indicators. The findings suggest varying relationships between corruption, poverty and economic growth across different countries. For example, while economic growth significantly affects corruption in the Philippines, the causality in Thailand is between poverty and economic growth, highlighting the need for tailored policy interventions to address each country's specific challenges (Yunan and Andini, 2018). In Pakistan, a study found a significant positive association between corruption, inflation and poverty, emphasizing the importance of improving the judiciary system and implementing the rule of law to combat corruption effectively (Bukhari *et al.*, 2022). Similarly, in Nigeria, despite democratic governance, pervasive corruption continues to fuel poverty, underscoring the need for structural reforms and institution-building to address the root causes of poverty (Ikharehon and Omoregie, 2015).

In Nepal, the interconnections between unemployment, economic inequality and poverty were examined, revealing significant influences on poverty levels. The findings stress the importance of addressing corruption, income inequality and unemployment to alleviate poverty and improve economic conditions (Bijukchhen and Phaju, 2023). In Kazakhstan, a comparative study with Argentina, Germany and Denmark highlighted the significant impact of corruption on poverty, suggesting the need for further research using advanced methodologies to understand the unique mechanisms at play in different countries (Zhanbozova *et al.*, 2023).

To analyze the impact of corruption on poverty in India, some of the studies have been conducted, for instances Daoud (2015) builds on Mundle *et al.*'s (2012) framework to investigate child poverty in India. The study finds that governance better explains child poverty than corruption, with the BORDA measure accounting for 60% of state variations. A unit improvement in BORDA reduces child poverty by 1%, confirmed across severe education, shelter and food deprivation contexts. Similarly, Vinayagathasan and Ramesh (2022) examine the relationship between corruption and poverty in SAARC countries, including India, from 1996 to 2019. Their findings indicate that a decrease in corruption and an increase in women's labor force participation significantly reduce poverty and enhance social welfare. Additionally, there is bilateral causality between corruption scores and poverty. Building on this, H and Hoque (2022) focus on recent years in India, finding that increasing corruption and crime rates significantly impact the public sector and economic development. The study explores strategies to mitigate these issues and enhance economic growth through policy recommendations, based on secondary qualitative data analysis. Extending the analysis to a broader regional context, Ching *et al.* (2019) investigate the relationship between corruption, poverty and public spending in Malaysia, India and Pakistan from 1996 to 2022 using a panel regression model. The main findings reveal a significant link between corruption and poverty, highlighting how these factors, along with public spending, influence economic performance in these developing countries. To conclude, the past studies clearly indicates that corruption plays a significant role in eradication poverty aligning with the existing theory that it is the institution that can play a significant role in combating corruption leading to reduction in poverty.

Transitioning to our final variable of focus, the ER, recent studies have shed light on its intricate relationship with poverty. For instance, in Russia, research analyzing informal employment from 2000 to 2020, using data from the Russian Longitudinal Monitoring Survey (RLMS HSE), reveals that approximately a quarter of Russian employees engaged in informal labor over this period. This engagement varied across different demographic groups, with men, young individuals and those with education below vocational secondary level being more likely to participate in informal employment, often receiving part or all of their pay informally. The

study also found a statistically significant relationship between informal employment and the risks of monetary poverty. While fully informal employment in 2019 increased the likelihood of a household falling into poverty, the situation reversed in 2020, decreasing this likelihood (Biryukova *et al.*, 2022). In Kenya, another study focused on poverty and unemployment among rural youth, proposing youth engagement in agripreneurship as a solution. The study, conducted between December 2020 and May 2021, suggests that youth involvement in agripreneurship could increase food production, addressing challenges of unemployment, poverty and food security. To support this, the study recommends entrepreneurial education, training and government support for agripreneurship ventures, aligning with SDGs and Vision 2030 goals for transforming smallholder agriculture and eradicating poverty (Ouko *et al.*, 2022). In the UK, a study examined the increase in self-employment and its correlation with high levels of in-work poverty, particularly among individuals transitioning from social security benefits. Policies encouraging a shift from unemployment to self-employment are seen to transfer social risks and employment responsibilities to individuals, highlighting the inadequacy of measures like the New Enterprise Allowance Scheme in addressing resource disadvantages and reducing associated risks (Danson *et al.*, 2021).

In India, a study analyzed the impact of demographic change, education decisions, labor force participation and economic changes on employment, labor productivity, real wages and poverty from 2005 to 2010. Using data from the NSS 66th Round Employment-Unemployment Survey and the 2011 Population Census, the study found positive trends in employment quality despite challenges in workforce growth. It highlighted improvements in labor productivity, real wages and a reduction in the proportion and count of the working poor during the period (Sundaram, 2017). In another study focusing on India, the MGNREGA, a rural employment guarantee scheme, was examined as a pivotal program for rural development, particularly in the state of Himachal Pradesh, with the goal of alleviating rural poverty and unemployment. The study's findings affirmed the scheme's significance in providing livelihoods and fostering self-sufficient villages, consequently reducing poverty. Nonetheless, the study recommended addressing drawbacks to enhance the program's benefits for rural communities (Sharma *et al.*, 2021).

In summary, we can conclude that despite the growing focus on the ER, there is a shortage of studies assessing its correlation with poverty levels and the effectiveness of policies aimed at improving it. Additionally, the lack of studies analyzing the nonlinear effects of the ER on poverty also warrants further attention.

3. Research design

This study uses a time series data set covering the years 1996–2022 to investigate the nonlinear effects of international RI growth rate, control of corruption (measured as global percentile rank) and employment-to-population ratio (modeled ILO estimate) on the reduction of poverty headcount ratio at $2.15 a day (2017 PPP) in India. The data for these variables were sourced from the World Bank's World Development Indicator Database (World Bank, 2022c) and analyzed using the R software.

The international RI growth rate signifies the percentage shift in the remittance amount transferred by expatriates to their home nation within a specified duration. This metric is indicative of the RI trend, which holds significant relevance for developing countries such as India, given that these inflows frequently constitute a substantial portion of the national income and can have implications for poverty levels. Control of Corruption, quantified as the global percentile rank, mirrors a country's effectiveness compared to others in combating corruption. A higher rank denotes superior control, indicating that the country is perceived to exhibit lower levels of corruption. This parameter is crucial as corruption can impede economic growth and development, thereby impacting poverty rates. The employment-to-population ratio, 15+, total

(%), provides an approximation of the fraction of the working-age populace that is employed. This metric is pivotal for evaluating the vitality of the labor market and its ramifications on poverty, as higher ERs are generally linked with lower poverty rates. The poverty headcount ratio at $2.15 a day (2011 PPP) delineates the proportion of the population living below this poverty threshold. With the escalation of the cost of living, poverty lines also escalate, underscoring the significance of this metric in comprehending the magnitude of poverty and the advancements in poverty alleviation endeavors over time

3.1 Research methodology

This study employs the NARDL model, an extension of the ARDL model that was propounded by Shin *et al.* (2014). While the ARDL model faced limitations in capturing asymmetric behaviors of variables, the NARDL model has effectively addressed this issue by accommodating and representing such asymmetries. Additionally, the NARDL model offers flexibility by allowing for the inclusion of stationary variables at either the level or first difference, as discussed by Shin *et al.* (2014). Furthermore, to enhance the interpretability of the results, this methodology provides a graphical representation of the cumulative dynamic multiplier, offering insights into how the independent variables adjust to both positive and negative shocks (Shin *et al.*, 2014). Notably, the NARDL model effectively handles issues related to non-linearity and non-stationarity by incorporating an unrestricted error correction model into its framework. In the framework of the NARDL model, it is crucial to incorporate lagged values of the independent variable, separating them into positive and negative components to account for both positive and negative shocks. Likewise, the model includes lagged values of the dependent variable, along with an error term. These values are then subjected to regression analysis, where they are assessed in relation to the dependent variable, yielding results. The mathematical linear equation is expressed as follows:

$$\mathrm{PO_T} = \beta_0 + \beta_1 \mathrm{RI} + \beta_2 \mathrm{CO} + \beta_3 \mathrm{ER} + \varepsilon_\mathrm{T} \tag{1}$$

Following equation (1) mentioned above, the variables PO, RI, Co. and ER correspond to the poverty, RI, control on corruption and ER. The model coefficients are represented by the values β_1, β_2 and β_3. The error term is symbolized by ε_T, and the constant term is denoted by β_0. The study examines asymmetric effects, necessitating the segmentation of independent variables into positive and negative components. This asymmetric formulation can be expressed as:

$$\mathrm{PO_T} = \beta_0 + \beta_1 \mathrm{RI}^+ + \beta_2 \mathrm{RI}^- + \beta_3 \mathrm{CO}^+ + \beta_4 \mathrm{CO}^- + \beta_5 \mathrm{ER}^+ + \beta_6 \mathrm{ER}^- + \varepsilon_\mathrm{T} \tag{2}$$

The aforementioned equation (2) aims to distinguish variables into positive and negative constituents. The positive component signifies the beneficial influence of independent variables on the poverty in India, whereas the negative component denotes the detrimental effect of independent variables on the same. Following this, the formulation of the NARDL model equation is structured as follows:

$$\mathrm{PO_T} = \alpha_0 + \sum_{\mathrm{i}=1}^{\mathrm{p}} \alpha_1 \mathrm{PO_{t-i}} + \sum_{\mathrm{i}=0}^{\mathrm{p1}} \alpha_2^* \mathrm{RI}^*_{\mathrm{T-i}} + \sum_{\mathrm{i}=0}^{\mathrm{p2}} \alpha_3^* \mathrm{CO}^*_{\mathrm{T-i}} + \sum_{\mathrm{i}=0}^{\mathrm{p3}} \alpha_4^* \mathrm{ER}^*_{\mathrm{T-i}} + \alpha_5 \mathrm{PO_{T-1}} + \alpha_6^* \mathrm{RI}^*_{\mathrm{T-i}} + \alpha_7^* \mathrm{CO}^*_{\mathrm{T-i}} + \alpha_8^* \mathrm{ER}^*_{\mathrm{T-i}} + \varepsilon_\mathrm{T} \tag{3}$$

According to equation (3), α_0 represents the constant value, while α_1, α_2, α_3, α_4, α_5, α_6, α_7 and α_8, represent the coefficients. The variables *p*, p1, p2 and p3 indicate lag orders, T represents time and ε_T represents the error term. Equations (5), (7) and 9 describe the short-term positive and negative partial sums, while equations (4), (6) and 8 describe the long-term positive and negative partial sums. These equations are used to capture the asymmetric effects of RI, effect of corruption and ER on poverty in India.

$$\sum_{i=0}^{p1} \alpha_2^{*} \mathrm{RI}_{T-i}^{*} = \sum_{i=0}^{p1} \left(\alpha_2^{+} \mathrm{RI}_{T-i}^{+} + \alpha_2^{-} \mathrm{RI}_{T-i}^{-}\right) \tag{4}$$

$$\alpha_6^{*} \mathrm{RI}_{T-1}^{*} = \alpha_6^{+} \mathrm{RI}_{T-1}^{+} + \alpha_6^{-} \mathrm{RI}_{T-1}^{-} \tag{5}$$

$$\sum_{i=0}^{p2} \alpha_3^{*} \mathrm{CO}_{T-i}^{*} = \sum_{i=0}^{p2} \left(\alpha_3^{+} \mathrm{CO}_{T-i}^{+} + \alpha_3^{-} \mathrm{CO}_{T-i}^{-}\right) \tag{6}$$

$$\alpha_7^{*} \mathrm{CO}_{T-1}^{*} = \alpha_7^{+} \mathrm{CO}_{T-1}^{+} + \alpha_7^{-} \mathrm{CO}_{T-1}^{-} \tag{7}$$

$$\sum_{i=0}^{p3} \alpha_4^{*} \mathrm{ER}_{T-i}^{*} = \sum_{i=0}^{p3} \left(\alpha_4^{+} \mathrm{ER}_{T-i}^{+} + \alpha_4^{-} \mathrm{ER}_{T-i}^{-}\right) \tag{8}$$

$$\alpha_8^{*} \mathrm{ER}_{T-1}^{*} = \alpha_8^{+} \mathrm{ER}_{T-1}^{+} + \alpha_8^{-} \mathrm{ER}_{T-1}^{-} \tag{9}$$

The initial stage of the NARDL model analysis involves assessing the stationarity of the selected variables. This is achieved through the Philip perron test and augmented Dickey–Fuller test (Dickey and Fuller, 1981; Phillips and Perron, 1988). It is essential for the variables to exhibit stationarity, either in levels or after first differencing, as underscored by Pesaran *et al.* (2001), for conducting NARDL analysis. Following the confirmation of stationarity, the subsequent step is to determine the appropriate lag length using information criteria such as AIC, SIC or HQ. The next step is to confirm cointegration among the variables. Cointegration is established when the F-statistic value exceeds the critical value threshold. Conversely, if the F-statistic is below the critical value of the lower bound, it indicates the absence of cointegration. Additionally, if the F-statistic falls between the upper and lower bound critical values, the result is inconclusive (Pesaran *et al.*, 2001). Once cointegration is confirmed, the next step involves testing for asymmetric effects using the WALD test. An asymmetric effect is indicated by a disparity between the positive and negative partial sums. The equations representing the asymmetric effect in both the short and long term can be expressed as follows:

$$\sum_{i=0}^{p1} \alpha_2^{+} \neq \sum_{i=0}^{p1} \alpha_2^{*-} \quad \text{(short run asymmetric effect of remittance inflow)}$$

$$\alpha_6^{+} \neq \alpha_6^{-} \quad \text{(long run asymmetric effect of remittance inflow)}$$

$$\sum_{i=0}^{p2} \alpha_3^{+} \neq \sum_{i=0}^{p2} \alpha_3^{*-} \quad \text{(short run asymmetric effect of effect of corruption)}$$

$$\alpha_7^{+} \neq \alpha_7^{-} \quad \text{(long run asymmetric effect of effect of corruption)}$$

$$\sum_{i=0}^{p3} \alpha_4^{+} \neq \sum_{i=0}^{p3} \alpha_4^{*-} \quad \text{(short run asymmetric effect of employment rate)}$$

$$\alpha_8^{+} \neq \alpha_8^{-} \quad \text{(long run asymmetric effect of employment rate)}$$

The NARDL equations, encompassing both short-term and long-term dynamics, are formulated to ascertain cointegration and accommodate asymmetric influences. The expression delineating the short-term NARDL model is presented as follows:

$$\mathrm{PO_T} = \beta_0 + \sum_{\mathrm{i}=1}^{\mathrm{p}} \beta_1 \mathrm{PO_{t-i}} + \sum_{\mathrm{i}=0}^{\mathrm{p1}} \left(\beta_2^{+} \mathrm{RI_{T-i}^{+}} + \beta_2^{-} \mathrm{RI_{T-i}^{-}}\right) + \sum_{\mathrm{i}=0}^{\mathrm{p2}} \left(\beta_3^{+} \mathrm{CO_{T-i}^{+}} + \beta_3^{-} \mathrm{CO_{T-i}^{-}}\right)$$
$$+ \sum_{\mathrm{i}=0}^{\mathrm{p3}} \left(\beta_4^{+} \mathrm{ER_{T-i}^{+}} + \beta_4^{-} \mathrm{ER_{T-i}^{-}}\right) + \mathrm{s_1 ECT_{T-1}} + \varepsilon_{\mathrm{T}} \tag{10}$$

Equation (10) represents the coefficients β_1, β_2, β_3 and β_4, where β_0 denotes the constant and ε_T represents the error term. The variable s_1 signifies the rate of adjustment, while the coefficients $\beta_2^{+}, \beta_3^{+}, and \beta_4^{+}$ indicate short-term positive shocks, and $\beta_2^{-}, \beta_3^{-}, and \beta_4^{-}$ denote short-term negative shocks. The NARDL equation for the long term can be expressed as follows:

$$\mathrm{PO_T} = \alpha_0 + \sum \alpha_1 \mathrm{PO_{T-1}} + \sum \left(\alpha_2^{+} \mathrm{RI_T^{+}} + \alpha_2^{-} \mathrm{RI_T^{-}}\right) + \sum \left(\alpha_3^{+} \mathrm{CO_T^{+}} + \alpha_3^{-} \mathrm{CO_T^{-}}\right)$$
$$+ \sum \left(\alpha_4^{+} \mathrm{ER_T^{+}} + \alpha_4^{-} \mathrm{ER_T^{-}}\right) + \varepsilon_{\mathrm{T}} \tag{11}$$

Equation (11) presents the coefficients α_1, α_2, α_3 and α_4, with the error term denoted as ε_T and the constant represented by α_0. Additionally, the variables $\alpha_2^{+}, \alpha_3^{+}, and \alpha_4^{+}$ signify long-term positive shocks, while $\alpha_2^{-}, \alpha_3^{-}, and \alpha_4^{-}$ represent long-term negative shocks.

3.2 Rationale for nonlinear autoregressive distributed lag model selection

The selection of the NARDL model for this research is strategically motivated by its ability to address the specific characteristics of the data and research questions. Compared to other methodologies like ARIMA, VAR, Granger Causality Analysis and Panel Data Analysis, NARDL offers several advantages that enhance its suitability for this study. The core strength of NARDL lies in its ability to capture non-linear relationships and asymmetries within the data. Economic phenomena, particularly those related to poverty reduction, often exhibit complex non-linear patterns. For instance, the impact of international RI growth rate or control of corruption on poverty reduction might not be linear. NARDL explicitly accommodates these non-linearities, providing a more accurate and nuanced understanding of the relationships compared to traditional linear models. Additionally, NARDL can

effectively capture asymmetric effects. The influence of a variable like employment-to-population ratio on poverty might differ depending on whether employment is increasing or decreasing. By incorporating these asymmetries, NARDL leads to a more comprehensive analysis of the factors influencing poverty reduction in India. Furthermore, NARDL's flexibility in handling stationary variables is another key advantage for this research. Poverty headcount ratio and RI growth rate might exhibit different levels of stationarity. NARDL's ability to include variables at either the level or first difference allows for a more tailored approach to modeling them, ensuring a more accurate capture of their dynamics. This flexibility enhances the model's ability to accurately represent the complex relationships between these variables and poverty reduction. Furthermore, NARDL provides a valuable graphical representation of the cumulative dynamic multiplier. This visualization offers crucial insights into how the independent variables (RI, corruption control, employment) influence the poverty headcount ratio over time. This enhanced interpretability facilitates a clearer understanding of the results, not only for researchers but also for policymakers seeking to design effective poverty reduction strategies based on the findings. In conclusion, the NARDL model's strengths in capturing non-linearities, accommodating asymmetries and offering a flexible approach to stationary variables make it the most suitable choice for this research. Its ability to address the specific characteristics of the data and research questions ensures a robust and comprehensive analysis of the impact of the chosen factors on poverty reduction in India.

4. Empirical findings

The descriptive statistics presented in Table 1 offer a comprehensive overview of the variables under study and their respective distributions. The Poverty headcount ratio (%) demonstrates a mean of 29.1363, indicating that, on average, approximately 29.14% of India's population lives below the $2.15-a-day (2017 PPP) poverty line. With a median value of 32.9, the distribution appears slightly skewed toward lower poverty levels, as the median exceeds the mean. The considerable range from 11.1–45.5 and a standard deviation of 12.53 highlight substantial variability in poverty levels across different periods. Regarding the growth in remittances (%), the mean stands at 12.07, suggesting an average annual growth rate of 12.08% in RIs to India. The positive mean indicates a general upward trend in RIs over time. The median of 10.24 hints at a skew toward lower growth rates, as the median falls below the mean. The wide range from −10.70–40.85 and a standard deviation of 13.77 indicate significant variability in remittance growth rates. In terms of the effect of

Table 1. Descriptive statistics

Units of variables	PO Poverty headcount ratio (%)	RI Growth in remittances (%)	CO Effect of corruption (%)	ER Employment to population ratio (%)
Mean	29.14	12.08	42.54	50.33
Median	32.90	10.25	43.62	51.38
Maximum	45.50	40.86	49.73	54.56
Minimum	11.10	−10.71	35.55	41.33
SD	12.53	13.78	3.87	4.12
Skewness	−0.14	0.28	−0.22	−0.54
Kurtosis	1.41	2.37	2.04	2.02

Source: Authors' calculation via R software

corruption (%), the mean is 42.53, indicating that, on average, India ranks around 42.54 in the global percentile rank for controlling corruption. A higher rank signifies better control of corruption. The median of 43.61 suggests a slight skew toward better corruption control, as the median exceeds the mean. The narrow range from 35.54–49.73 and a standard deviation of 3.87 indicate relatively low variability in corruption control rankings. Regarding the employment-to-population ratio (%), the mean is 50.32, indicating that, on average, approximately 50.33% of India's working-age population is employed. The median of 51.37 implies a slight skew toward higher ERs, as the median surpasses the mean. The narrow range from 41.33–54.55 and a standard deviation of 4.12 suggest relatively low variability in ERs. The data indicates that higher remittance growth, improved corruption control and higher ERs are associated with lower poverty headcount ratios in the country.

4.1 Unit root test

The NARDL approach is designed to handle variables with mixed orders of stationarity. To ascertain the stationarity of the variables at either the level or first difference, the Philip Perron unit root test and the Augmented Dickey–Fuller unit root test were used (Dickey and Fuller, 1981; Phillips and Perron, 1988). The results of both tests indicated that, at the level, only the variable RI demonstrated significance, while all other variables were deemed insignificant at the 5% level of significance. Conversely, at the first difference, all variables PO, RI, Co. and ER were found to be stationary. The detailed results of the unit root tests are presented in Table 2.

4.2 Nonlinear autoregressive distributed lag bound test results

The bounds test for NARDL model is a statistical method used to determine the presence of a long-run relationship between variables. In this test, the F-statistic is compared to critical bound values to assess the significance of the relationship. In Table 3, the F-statistic is 7.47. The critical bound values are provided for different significance levels (10%, 5%, 2.50% and 1%) and for two different cases: when the variables are integrated of order 0 (I(0)) and when they are integrated of order 1 (I(1)). For the I(0) case, the critical bound values range from 1.99–2.88 at the 10% and 1% significance levels, respectively. For the I(1) case, the critical bound values range from 2.94–3.99 at the same significance levels. Since the F-statistic of 7.47 exceeds all the critical bound values, we can conclude that there is a significant long-run relationship between the variables in the NARDL model. This indicates that the variables,

Table 2. Unit root test

		Philip perron test		Augmented dickey fuller test	
Stationary levels	Variable	*t*-statistic	*p*-value	*t*-statistic	*p*-value
At level	PO	−0.1524	0.9331	−0.0764	0.9422
	RI	−4.7418	0.0008	−4.7418	0.0008
	CO	−2.3054	0.1778	−2.1551	0.2263
	ER	−0.5814	0.8585	0.3915	0.9780
At first difference	PO	−3.4237	0.0197	−4.0159	0.0053
	RI	−13.5053	0.0000	−6.7647	0.0000
	CO	−5.4272	0.0002	−5.4146	0.0002
	ER	−3.6865	0.0109	−1.9893	0.0219

Source: Authors' calculation via R software

Table 3. NARDL bounds test

Significance	F-statistics 7.47 Critical bound value I (0)	I (1)
10%	1.99	2.94
5%	2.27	3.28
2.50%	2.55	3.61
1%	2.88	3.99

Source: Authors' calculation via R software

which in this case are RI growth, corruption and employment-to-population ratio, have a lasting impact on reducing the poverty headcount ratio in India.

4.3 Short run and long run results

Table 4 displays the results the short-run and long-run impacts of international RI growth rate (RI), control of corruption (Co.) and ER on the poverty headcount ratio at $2.15 a day (PO) in India.

Beginning with the short-run impacts, a positive shock (+) in the growth rate of international RI results in a decrease in the poverty headcount ratio. This is evidenced by the coefficient of −0.1854, which is statistically significant at the 5% level with a *p*-value of 0.0018. One reason for this could be that remittances directly provide income to recipient households, enabling them to fulfill basic needs such as food, shelter and healthcare, thus lifting them out of poverty. Moreover, remittances can stimulate economic activity in recipient communities, leading to job creation and increased household income, further reducing poverty by offering more opportunities for economic advancement. This finding aligns with the results of Musakwa and Odhiambo (2022), who found a positive effect of RIs on poverty reduction in Tanzania. Conversely, a negative shock (-) in RI leads to an increase in the poverty headcount ratio, as indicated by the coefficient of 0.0920, although this result is not statistically significant at the 5% level (*p*-value = 0.0628). The short run result for control of corruption (Co.) also indicated significant effects. A positive shock in Co. leads to a decrease in the poverty headcount ratio, as indicated by the coefficient of −0.5491 with a *p*-value of 0.0088. This suggests that reducing corruption can lead to immediate benefits in poverty alleviation by improving resource allocation and fostering a more conducive

Table 4. Short run and long run result

	Short run result				Long run result			
Variable	Coefficient	Std. error	*t*-Statistic	*p*-value	Coefficient	Std. error	*t*-Statistic	*p*-value
RI+	−0.1854	0.0475	−3.8986	0.0018	−0.0952	0.0442	−2.1529	0.0500
RI-	0.0920	0.0372	2.4723	0.0628	0.1007	0.0510	1.9764	0.0697
CO+	−0.5491	0.1785	3.0761	0.0088	0.6010	0.2029	2.9628	0.0611
CO-	−0.3817	0.1619	−2.3575	0.0947	−0.0288	0.1774	−0.1625	0.8734
ER+	−3.5502	0.7958	4.4611	0.0006	3.8859	1.3088	2.9691	0.0709
ER-	−0.2147	0.3748	−0.5730	0.5765	5.6675	2.1597	2.6243	0.0210
ECT	−0.9136	0.0953	−9.5913	0.0000				

Source: Authors' calculation via R software

economic environment. Vinayagathasan and Ramesh (2022) also found similar results in a study of SAARC nations, where corruption was found to be a significant factor affecting poverty in the short run. However, a negative shock in Co. does not have a significant impact on the poverty headcount ratio (coefficient = −0.3817, *p*-value = 0.0947). Finally, the short run result for ER also aligned with the result of RIs growth and effects of corruption by indicating a significant positive impact on reducing the poverty headcount ratio. A positive shock in ER leads to a decrease in the poverty headcount ratio, as indicated by the coefficient of −3.5502 with a *p*-value of 0.0006. An increase in the ER reduces the poverty headcount ratio through several economic mechanisms. It boosts household income, decreases reliance on social assistance and stimulates consumption, thereby lifting individuals above the poverty threshold and reducing overall poverty levels. Omene (2021) also concluded a similar finding in the case of Nigeria, citing the recommendation that employment should be the focal point for the government to eradicate poverty. However, a negative shock in ER does not have a significant impact on the poverty headcount ratio (coefficient = −0.2147, *p*-value = 0.5765).

Moving to the long-run impacts, a positive shock in RI has a significant but smaller impact on reducing the poverty headcount ratio, as indicated by the coefficient of −0.0952 with a *p*-value of 0.0500, which is significant at the 5% level. In the long run, RIs can reduce the poverty headcount ratio by stimulating economic growth. Remittances increase household income, leading to higher consumption and investment, which, in turn, can create employment opportunities and improve living standards, ultimately reducing poverty. This finding aligns with the study of Pakistan, in which Ali *et al.* (2021) confirmed that RIs help reduce poverty in the long run. A negative shock in RI also has a smaller impact on increasing the poverty headcount ratio, but this result is not statistically significant at the 5% level (coefficient = 0.1007, *p*-value = 0.0697). In the long run, control of corruption (Co.) shows a positive impact on reducing the poverty headcount ratio. A positive shock in Co. leads to a decrease in the poverty headcount ratio, as indicated by the coefficient of 0.6010 with a *p*-value of 0.0611, although the result was found insignificant. Similarly, a negative shock in Co. does not have a significant impact on the poverty headcount ratio (coefficient = −0.0288, *p*-value = 0.8734). The ER has a positive impact on reducing the poverty headcount ratio in the long run. A positive shock in ER leads to a decrease in the poverty headcount ratio, as indicated by the coefficient of 3.8859 with a *p*-value of 0.0709, although the result was found insignificant. While a negative shock in ER has a significant impact on increasing the poverty headcount ratio, as indicated by the coefficient of 5.6675 with a *p*-value of 0.0210, which is significant at the 5% level. In the long run, a decrease in the ER can increase the poverty headcount ratio due to reduced income levels, leading to decreased purchasing power and overall economic activity. This can create a cycle of poverty as fewer job opportunities contribute to persistent economic hardship for individuals and households. In a recent study of Slovakia, Bžanová and Kováč (2024) found similar findings indicating that employment plays a crucial role in reducing poverty. The error correction term (ECT) is significant, indicating that the model adjusts back to its long-run equilibrium after a shock. In the short run, the coefficient of −0.9136 with a *p*-value of 0.0000 indicates that the model corrects deviations from the long-run equilibrium at a fast rate.

4.4 Model robustness test results

Table 5 presents the results of the model robustness for the NARDL model. The Wald test for an asymmetric relationship shows an F-statistic of 10.0182 with a *p*-value of 0.0020, indicating that there is a significant asymmetric relationship between the variables in the model. This suggests that the impact of shocks to the independent variables on the dependent

Table 5. Asymmetry and diagnostic test result

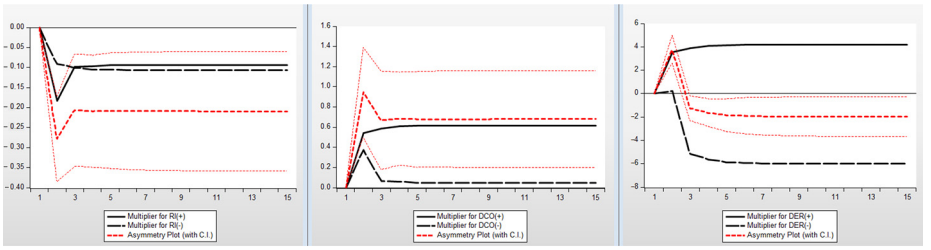
Tests	F-Statistics	*p*-value
Wald test for asymmetric relationship	10.0182	0.0020
LM test for autocorrelation	1.0562	0.3805
Brush Pegan Godfrey test for heteroskedasticity	2.6529	0.0511
Jarque Bera test for normality	0.7219	0.6970

Source: Authors' calculation via R software

variable is not the same in both directions, indicating a nonlinear relationship. The LM test for autocorrelation shows an F-statistic of 1.0562 with a *p*-value of 0.3805, indicating that there is no significant autocorrelation in the model. This suggests that the error terms in the model are not correlated with each other, which is an important assumption in regression analysis. The Breusch Pagan Godfrey test for heteroskedasticity shows an F-statistic of 2.6529 with a *p*-value of 0.0511, indicating that there is only minor evidence of heteroskedasticity in the model. Heteroskedasticity means that the variance of the error terms is not constant across observations, which can affect the efficiency of the estimates. While the *p*-value is slightly above the conventional significance level of 0.05, indicating borderline significance, it is still worth considering the implications of heteroskedasticity on the model's results. Finally, the Jarque Bera test for normality shows a test statistic of 0.7219 with a *p*-value of 0.6970, indicating that the residuals in the model are normally distributed. This is important for the validity of the model's estimates, as violations of normality assumptions can lead to biased parameter estimates and incorrect inferences.

4.5 Dynamic multiplier graph

Figure 1 illustrates dynamic multiplier graphs derived from a NARDL model. These graphs serve to analyze the time-varying relationship between two variables, where the influence of one variable on the other may not remain constant or may be contingent upon the magnitude of change in the first variable. In this context, the graphs depict the impact of RI growth (RI), control on corruption (DCO) and employment rate (ER) on the poverty headcount ratio in India over time. The *y*-axis of each graph represents the multiplier, indicating the extent to which a change in the independent variable will subsequently alter the dependent variable (poverty headcount ratio). Meanwhile, the *x*-axis represents the percentage change in the independent variable. For RI gowth (RI), the graph reveals that the line for positive RI growth (multiplier for RI(+)) is generally negative and declining. This implies that increases in RIs are correlated with



Source: Authors' calculation via R' software

Figure 1. Dynamic multiplier graph

reductions in poverty. Conversely, the line for negative RI growth (multiplier for RI(-)) is steeper and also negative, indicating that decreases in RIs have a more pronounced negative impact on poverty compared to the positive impact of increases in RIs. Regarding control of corruption (DCO), both the lines for positive and negative changes in DCO (multiplier for DCO(+) and multiplier for DCO(-)) are negative. This suggests that both increases and decreases in the level of corruption control are associated with reductions in poverty, with a stronger effect observed for increases in DCO. Concerning the employment rate (ER), the graph indicates that the line for positive DER growth (multiplier for DER(+)) is negative, indicating that increases in the ER are linked to decreases in poverty. Conversely, the line for negative DER growth (multiplier for DER (-)) is positive, suggesting that decreases in the ER are associated with increases in poverty. Notably, the line for negative DER growth is steeper than the line for positive DER growth, indicating that the detrimental impact of decreases in the ER outweighs the positive impact of increases in the ER.

In conclusion, the findings suggest that increases in RIs and improvements in the control of corruption are associated with reductions in poverty. Similarly, an increase in the ER is linked to a decrease in poverty. However, the impact of these variables on poverty reduction is not uniform over time, highlighting the importance of considering the dynamic nature of these relationships.

5. Conclusion and policy recommendation

This study makes several significant contributions to the existing literature on poverty in India. First, it examines the simultaneous impact of three structural factors – international RI growth rate, control of corruption and employment-to-population ratio – on poverty, offering insights into their combined long-term effects on the economy. The findings reveal that while short-term improvements in these factors are associated with reduced poverty, the long-term impact is sustained primarily by positive changes in RIs and strengthened control of corruption. These results highlight the complexity and dynamism of poverty reduction, emphasizing the necessity of addressing multiple factors simultaneously for sustained progress.

Furthermore, unlike previous studies, this research investigates the nonlinear effects of these structural factors on poverty, which is particularly relevant for developing nations like India. The nonlinearities observed underscore the need for nuanced policy interventions that consider the intricate interactions between these factors. Finally, this study aligns with the United Nations' SDG 1, which aims to end poverty in all its forms everywhere. By providing evidence-based insights into the drivers of poverty reduction, this research contributes to the broader discourse on achieving SDG 1.

Building upon these findings, policymakers are urged to adopt a multifaceted approach to effectively address poverty in India. Efforts should be directed toward enhancing the flow of international remittances by improving financial infrastructure and reducing transaction costs. Additionally, measures aimed at strengthening control of corruption, including the implementation of transparent governance practices and rigorous enforcement of anti-corruption laws, are crucial. Moreover, policies should focus on promoting employment generation, particularly in sectors with high poverty prevalence, through targeted interventions such as skill development programs and investment in job-creating industries. By concurrently addressing these factors, policymakers can significantly enhance the impact of poverty alleviation efforts in India, ultimately contributing to the achievement of SDG 1.

6. Limitation and future scope of study

Limitations of this study encompass the utilization of data spanning from 1996 to 2022, potentially excluding recent trends or shifts in the examined factors. Moreover, the study's focus

on the specific context of India raises questions about the generalizability of the findings to other countries or regions. Future research could delve into the effects of these factors on poverty in diverse settings to offer a more comprehensive perspective. Longitudinal studies could be undertaken to monitor changes in these variables and their impact on poverty, thereby shedding light on the efficacy of policy interventions. Additionally, further research could explore the interplay between these factors and other unconsidered variables, such as educational or health outcomes, to provide a more holistic understanding of poverty alleviation strategies.

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