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Remittances and Investment in India: An Empirical Inquiry

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ABSTRACT

India is the largest recipient of remittances globally. Despite its significance, there remains a gap in the literature regarding the impact of remittances on investment levels in India. This study examines the cointegration properties and stability of the relationship between remittances and selected macroeconomic variables over the period 1978–2015. Employing the Johansen cointegration test alongside a Vector Error Correction Model (VECM), the analysis investigates the long-run equilibrium and short-run dynamics of these variables. Unit root and stationarity tests confirm that the selected variables are integrated of order one. The findings from the Johansen cointegration analysis indicate the presence of a stable long-run relationship among the included variables. Furthermore, the results from the VECM suggest a significant short-run adjustment mechanism, implying that any deviations from the long-run equilibrium in the current quarter are corrected in subsequent quarters.

1. Introduction

Remittances refer to the portion of migrant workers' earnings that are transferred from their country of employment to their country of origin. They constitute a significant component of international capital flows between nations (Assaf & Malki, 2014). In developing economies, workers' remittances serve as a crucial source of foreign exchange reserves (Hossain *et al.*, 2012). According to the World Bank (2016),

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remittance inflows to developing countries amounted to $432 billion in 2015, surpassing official development assistance by more than threefold. India emerged as the largest recipient, receiving an estimated $72 billion, followed by China ($64 billion) and the Philippines ($30 billion).

Over the past two decades, remittances have remained as table and vital source of foreign exchange in South Asia, contributing approximately 1% of the GDP of member countries. In 2015, Nepal was the most remittance-dependent country, with remittances accounting for 32% of its GDP. Other South Asian nations, including Sri Lanka (8.5%), Bangladesh (7.9%), and Pakistan (7.2 %), followed in sequence (World Bank, 2016). Although India receives the highest volume of remittances globally, its dependence on them is relatively moderate, accounting for approximately three percent of its GDP. The process of globalisation and economic liberalisation, initiated in the early 1990s, has contributed to a significant rise in international migration from India, leading to a corresponding increase in remittance inflows. Migrant workers thus represent an important and stable source of external financial support for households in their home regions (Dutta *et al.*, 2016). Existing literature suggests that remittances play a critical role in socio-economic development, influencing both direct and indirect growth channels (Rao & Hassan, 2010). Globally, remittances as a percentage of GDP increased from 0.42% in 1980 to 0.76% in 2008. In developing countries, this share rose from 2% in 1986 to nearly 5% in 2008, highlighting their potential as a significant source of financial development. From a research perspective, a key concern is how remittances are allocated—whether they are primarily directed toward consumption or investment. This study seeks to examine the relationship between remittances and investment, along with other selected macroeconomic variables.

The remainder of this paper is structured as follows: Section 2 provides a review of the literature on the developmental impact of remittances. Section 3 outlines the data and methodology, presenting the empirical findings of the study. Finally, Section 4 concludes with key insights and implications.

2. Literature Review

The role of remittances in shaping economic outcomes has been a subject of extensive scholarly debate. Traditionally, research on remittances has predominantly focused on their impact on economic growth, with a growing body of literature also exploring their implications for poverty alleviation and income inequality. Empirical studies, particularly those based on cross-country data, have highlighted the positive, direct, or indirect effects of remittances on national economies (Rao & Hassan, 2010; Ratha, 2003). However, early research remained inconclusive, and until the late 1980s, scholars largely dismissed the idea that remittances could serve as a catalyst for economic development. A prevailing argument during this period was that remittance inflows were primarily utilised for immediate consumption, debt

repayment, and other non-productive expenditures, with limited impact on long-term economic growth (Lipton, 1980; Massey, 1988).

As the discourse evolved, some studies suggested that remittances might even have a detrimental effect on economic growth. Chemi *et al.* (2003) argued that the inflow of remittances could create a moral hazard, discouraging productive economic activity among recipients. Similarly, Acosta *et al.* (2007) contended that remittances could reduce labour force participation by increasing the demand for leisure and raising the reservation wage, ultimately discouraging employment and economic engagement. Contrary to these perspectives, a significant body of literature has emerged underscoring the developmental benefits of remittances, particularly in enhancing household welfare and reducing poverty. Scholars have highlighted that remittance-receiving households allocate a substantial portion of their income to essential services such as healthcare and education, which, in turn, contribute to long-term human capital development (Kanaiaupuni & Donato, 1999; Adams, 2003; Adams & Page, 2005). Adams (2005), in his study on Guatemala, demonstrated that both internal and international remittances played a pivotal role in reducing poverty by supplementing household income. Moreover, Adams (2007) provided evidence that remittance-receiving households exhibited a higher propensity to save compared to non-recipients, creating opportunities for financial intermediaries to expand credit to the private sector. This expansion of credit, in turn, fostered investment-led growth.

The effectiveness of remittances in promoting investment, however, depends significantly on the institutional framework and financial infrastructure of a country. Bjuggren *et al.* (2010) emphasised that financial intermediation and institutional quality play a crucial role in determining how remittances are channelled into productive investments. Institutional differences across countries have been widely acknowledged as key determinants of long-term economic growth (North *et al.*, 1973). Factors such as political stability, property rights, and the risk of capital loss influence the extent to which remittances contribute to economic development. North (1990) further elaborated on the role of institutions, defining them as structured societal rules that facilitate efficient resource utilisation and create incentives for investment and innovation.

Theoretical perspectives have also contributed to the understanding of remittance behaviour. The New Economics of Labour Migration (NELM), introduced by Stark & Bloom (1985), provides a life-cycle perspective on remittances. According to this framework, remittances follow a dynamic pattern: in the initial stages, migration costs result in negative net remittances; as migrants establish themselves, remittance flows increase, but they eventually decline if the migrant decides to settle permanently in the

host country. This perspective highlights the evolving nature of remittance flows and their implications for both short-term household welfare and long-term economic stability. The broader macroeconomic impact of remittances has been further examined in the context of institutional strength and policy environments. The World Human Development Report (2006) suggests that countries with robust institutions, a highly skilled labour force, and favourable policy frameworks can better harness remittance inflows for investment and growth. Empirical evidence from specific country studies further supports this notion. For instance, Chowdhury & Chowdhury (1992) found that remittances significantly contributed to domestic savings, investment, and overall economic growth in Bangladesh. Osili (2004), in his study on Nigeria, observed that a substantial portion of remittances was directed toward housing investments, with a 10% increase in remittance income leading to a 3% rise in housing investment. Similarly, Mishra (2006) found that in Caribbean countries, a 1% increase in remittance inflows was associated with a 0.6% increase in domestic private investment.

While remittances can serve as an alternative source of external financing, their ability to influence economic growth is contingent upon the policy and institutional environment of the recipient country. Buch & Kuckulenz (2004) emphasised that the intensity of the growth effect of remittances is highly dependent on government policies and investment climates. Ziesemer (2008) proposed a savings network model, arguing that remittances contribute to economic growth by increasing national savings, which subsequently promotes capital accumulation and investment. More recent studies have provided empirical evidence reinforcing this argument. Using data from 30 Sub-Saharan African countries spanning 1980 to 2004, Balde (2011) found that both remittances and foreign aid positively influenced savings and investment. Similarly, Hossain & Hasanuzzaman (2012) demonstrated that in Bangladesh, remittances, coupled with trade openness, significantly enhanced investment levels. These findings challenge earlier assumptions that remittances are predominantly spent on consumption and provide strong evidence for their role in fostering economic development.

Despite the wealth of research on remittances, much of the existing literature has centred on their macroeconomic implications, poverty reduction effects, and household welfare benefits. However, there remains a notable gap in research specifically examining the direct link between remittances and investment. While some studies have alluded to the potential for remittances to stimulate investment, a more comprehensive analysis is required to understand the mechanisms through which remittance inflows translate into productive investments. This study seeks to address this gap by exploring the intricate relationship between remittances, investment, and selected macroeconomic variables. By doing so, it aims to provide a nuanced understanding of how remittance inflows can be leveraged as a driver of sustainable economic growth.

3. Empirical Methodology

3.1 Variable Description

In this study, we investigate the relationship between remittances and investment using annual data from 1978 to 2015. Investment is defined as expenditures aimed at enhancing future output or income, including the purchase of machinery, equipment, and plants, as well as the construction of infrastructure such as railways, roads, schools, and hospitals. Additionally, expenditures on residential, commercial, and industrial buildings, along with improvements in property quality, such as fencing and irrigation channels, are also considered investments. To quantify investment, we follow the World Bank's measure of gross fixed capital formation as a percentage of GDP (Investment/GDP), which captures the share of investment in aggregate output.

Remittances, the primary explanatory variable in our study, are financial transfers made by migrants to their home countries and are closely linked to international migration. To analyze the determinants of investment, we adopt the empirical approach used by Balde (2011), incorporating key macroeconomic variables such as income per capita (Wai & Wai, 1989; Greene & Villanueva, 1991), interest rates (Greene & Villanueva, 1991; Balde, 2011), savings (Feldstein & Horioka, 1980; Balde, 2011), and inflation (Serven & Solimano, 1992).

For measuring inflation, we use the GDP deflator instead of the Consumer Price Index (CPI), as the GDP deflator captures price changes across all goods and services produced in the economy. This approach is consistent with the broader literature, where the GDP deflator is commonly used as a preferred measure of inflation (Dornbusch *et al.*, 2003).

3.2 Data Source

The data for all explanatory variables used in this study are sourced from the World Development Indicators. To examine the relationship between investment and the selected variables, we utilise annual data spanning from 1978 to 2015. To address potential heteroscedasticity, the data is transformed into its logarithmic form, as log transformation helps to standardise the scale of measurement and mitigate variability issues (Gujarati, 1995). The variables in their logarithmic forms are represented as follows: LNINV for Investment, LNREM for Remittances, LNY for GDP per capita, LNL_INT for Lending Interest Rate, LNODA for Official Development Assistance (ODA), LNINF for Inflation, and LNS for Savings. A summary of these variables is provided in the accompanying Table 1.

Table 1 Descriptions of the Variables

Variables	Details	Source
INV	Gross fixed capital formation as a percentage of GDP	
REM	Migrant remittances as a percentage of GDP	
NY	Real GDP per capita	World
L_INT	Lending interest rate	Development
ODA	Foreign-aid (official development assistance), percentage of	Indicators (WDI)
GDP, INF	GDP deflator	
S	Savings as a percentage of GDP	

3.3 Methods

3.3.1 Stationarity Tests

To prevent spurious regression results in time series analysis, it is essential to examine whether the data exhibits unit roots or non-stationarity. In this study, we assess the stationarity properties of the variables by employing two widely accepted unit root tests: the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test. These tests are applied to all logarithmic series as well as their first differences to determine the order of integration. The ADF test equation incorporates both the intercept and trend components, represented as follows:

$$\Delta X_t = \phi_0 + \beta t + \rho X_{t-1} + \sum_{i=1}^{P} \gamma_i \Delta X_{t-1} + \varepsilon_t \quad (1)$$

The ADF test relies on the t-statistic derived from the estimated coefficient of ρ. The probability distribution of this statistic is a function of the Wiener process, which describes the Brownian motion of a particle subjected to numerous molecular shocks (Maddala & Kim, 1998). In contrast, the Phillips-Perron (PP) test extends the standard Dickey-Fuller (DF) unit root test by applying a non-parametric correction factor, making it more robust to serial correlation and heteroskedasticity.

3.3.2 Cointegration

After establishing the stationarity properties of the data, the study proceeded with a cointegration analysis to determine whether a stable, long-term relationship exists among the selected variables, thereby avoiding spurious correlations. To achieve this, we employed the Johansen and Juselius (1990) cointegration approach, which is widely recognised for its robustness in identifying multiple cointegrating relationships in a multivariate framework.

This method utilises two key statistical tests—the Maximum Eigenvalue test and the Trace test—to ascertain the number of cointegrating vectors within the dataset. The test statistics are computed using the following equation:

$$Trace = T\sum_{i=r+1}^{p} Ln(1-\lambda i) \quad (2)$$

Where, λ_{r+1},.....$\lambda_p$are $p-r$ represent the smallest estimated eigenvalues of the stochastic matrix. The likelihood ratio (LR) test statistic is then used to evaluate the null hypothesis r cointegrating vectors against the alternative hypothesis of $r+1$ cointegrating vectors. This is formally expressed through the Maximum Eigenvalue test, given by:

$$\Lambda_{max} = -T[ln(1-\lambda_i)] \quad (3)$$

The decision rule for cointegration is based on the comparison between the calculated test statistics and their respective critical values. If the computed Trace statistic or Maximum Eigenvalue statistic exceeds the critical threshold, the null hypothesis of no cointegration is rejected in favour of the existence of a long-run equilibrium relationship among the variables.

3.3.3 Vector Error Correction Model (VECM)

Following the Johansen cointegration test, the study employed the Vector Error Correction Model (VECM) to capture both the short-run and long-run dynamics of the selected variables. The VECM is a widely used econometric technique that allows for the assessment of how short-term fluctuations in variables adjust toward their long-term equilibrium relationship. This framework incorporates an Error Correction Mechanism (ECM), which not only quantifies short-run deviations from equilibrium but also measures the speed at which these deviations are corrected over time (Engle & Granger, 1987). The ECM ensures that any disequilibrium in the system is gradually corrected, thereby maintaining the stability of the long-run relationship between the variables. For a system comprising two variables, say Y (investment) and X (remittances), the VECM is formulated as follows:

$$lnY_t = \alpha + \sum_{i=t}^{m} \beta_i lnX_{t-i} + \sum_{j=1}^{n} \gamma_j lnY_{t-j} + u_t$$

$$lnX_t = \theta + \sum_{i=t}^{p} \pi_i lnX_{t-i} + \sum_{j=1}^{r} \Phi_j lnY_{t-j} + v_t \quad (4)$$

OR (5)

$$\Delta lnY_t = \alpha + \sum_{i=t}^{m} \beta_i lnX_{t-i} + \sum_{j=1}^{n} \gamma_j \Delta lnY_{t-j} + \delta ECM_{t-i} + u_t$$

$$\Delta lnX_t = \theta + \sum_{i=t}^{p} \pi_i \Delta lnX_{t-i} + \sum_{j=1}^{r} \Phi_j \Delta lnY_{t-j} + \lambda ECM_{t-i} + v_t \quad (6)$$

In these equations, u_t and v_t represents a stochastic disturbance term with zero mean and no serial correlation, while the error correction mechanism is denoted by ECM. If the variables in the system are integrated of order one [I(1)] but do not exhibit cointegration, then a standard first-difference model is Applied without the error correction term, as given by:

$$\Delta lnY_t = \alpha + \sum_{i=t}^{m} \beta_i \Delta lnX_{t-i} + \sum_{j=1}^{n} \gamma_j \Delta lnY_{t-j} + u_t \quad (7)$$

$$\Delta lnX_t = \theta + \sum_{i=t}^{p} \pi_i \Delta lnX_{t-i} + \sum_{j=1}^{r} \Phi_j \Delta lnY_{t-j} + v_t \quad (8)$$

4. Results

4.1 Stationarity Test Results

According to the ADF and PP test statistics, if the computed values fall below the critical values, the corresponding variable series—INV, REM, NY, L_INT, and ODA—are considered stationary or integrated at level I (0). However, if the test results indicate insignificance at any level, the tests are reapplied to the first differences of the variables (denoted as ΔX). If stationarity is achieved in the first differences, the variables are said to be integrated of order one, I(1) (Dickey & Pantula, 1987). Based on the test results, we find that all selected variables are non-stationary in their levels but attain stationarity upon first differencing. Therefore, we conclude that the data series are integrated of order I(1). The results of both ADF and PP tests are summarised in Table 2.

Table 2 Estimated Statistics of Unit Root Tests

Series	Augmented Dickey-Fuller Test Statistics		Phillips Perron Test Statistics	
	Level	First Difference	Level	First Difference
LNINV	-1.520	-5.905	-1.523	-5.938
LNREM	-0.952	-7.956	-1.183	-7.802
LNY	3.390	-6.854	4.809	-6.666
LNL_INT	-0.971	-6.048	-0.901	-8.804
LNODA	-0.710	-8.148	-0.931	-10.435
LNINF	-1.413	-10.561	-3.507	-10.711
LNS	-0.728	-9.475	-0.959	-9.266

Note: All first difference values are significant at 5% level of significance.

4.3 Cointegration Test Results

The results of the Johansen cointegration test, presented in Table 3, indicate the presence of four cointegrating equations at the 1% significance level. This finding strongly suggests that remittances, investment, and other explanatory variables share a stable and statistically significant long-run relationship. The presence of cointegration implies that any short-term fluctuations in the data will eventually adjust toward equilibrium, reinforcing the theoretical linkages between remittances and investment dynamics. By confirming this long-term association, our study underscores the importance of remittance inflows as a key determinant of investment decisions within the economy.

Table 3 Result of the Cointegration Test

Trace Test				
Hypothesized No. of CE(s)	*Eigenvalue*	*Trace Statistic*	*0.05 Critical Value*	*Prob.***
None*	0.7824	192.54	125.615	0.0000
At most 1	0.6959	137.64	95.753	0.0000
At most 2	0.6674	94.79	69.818	0.0002
At most 3	0.5615	55.16	47.856	0.0088
Maximal Eigenvalue Test				

Hypothesized No. of CE(s)	***Eigenvalue***	***Max-Eigen Statistic***	***0.05 Critical Value***	***Prob.*****
None*	0.7823	54.89	46.231	0.0047
At most 1	0.6958	42.84	40.077	0.0237
At most 2	0.6673	39.62	33.876	0.0092
At most 3	0.5615	29.68	27.584	0.0265

Trace test indicates 4 cointegrating equations at the 0.05 level

Maximal Eigenvalue test statistics indicate 4 cointegrating equations at 0.05 level

*Denote rejection of the hypothesis at the 0.05level**Mackinnon–Haug-Michelis (1991) p-values

4.4 VECM Test Results

The empirical results of the VECM estimation are presented in Table 4. A key finding is that the coefficient of the error correction term (ECT) carries a negative sign and is statistically significant at the 1% level. This indicates that any short-term disequilibrium in investment is systematically corrected over time, pushing the system back toward its long-run equilibrium state. Specifically, the study finds that the speed of adjustment of investment toward equilibrium is 52.5%, implying that more than half of any deviation from the equilibrium level in one period is corrected in the subsequent period.

Table 4 Estimation of Vector Error Correction Model

Variables	**Coefficient**	**t-statistics**
ECT	-0.525	-1.9623
D(LNREMIT(-1))	0.1251	3.0090
D(LNY(-1))	2.0501	5.5847
D(LNODA(-1))	0.0126	0.5067
D(LNS(-1))	0.1619	1.0138
D(LNINF(-1))	0.0928	3.6184
D(LNL_INT(-1))	0.1129	1.3040

R-squared	0.751220	Log likelihood	82.73861
Adj. R-squared	0.691170	AkaikeAIC	-4.039925
F-statistic	12.50987	Schwarz SC	-3.691618

Source: Author's calculation by using E-views Software

The magnitude of the error correction term plays a crucial role in determining the pace at which the economy returns to its long-term path. A larger absolute value of the ECT coefficient signifies a faster rate of adjustment, ensuring that the system swiftly corrects any short-term imbalances. Conversely, a smaller absolute value suggests a lower speed of adjustment, indicating a prolonged period of disequilibrium before convergence to the steady-state relationship.

Furthermore, the short-run dynamics of the model reveal that remittances exert a statistically significant and positive impact on investment. This finding aligns with economic theory, suggesting that inflows of remittances contribute to capital formation and investment in productive sectors. In addition, GDP and inflation are also found to have a significant positive influence on investment in the short run. The positive impact of GDP is expected, as higher economic output typically fosters greater investment activities. Meanwhile, the positive association between inflation and investment suggests that moderate inflation may create an environment where firms anticipate higher future returns, thereby stimulating investment.

In summary, the VECM results reinforce the existence of a strong long-run relationship between remittances and investment while also highlighting the significance of short-run adjustments. The speed at which deviations from equilibrium are corrected underscores the responsiveness of investment to changes in remittance inflows, GDP growth, and inflation. These findings have important policy implications, suggesting that stable and sustained remittance inflows can play a pivotal role in enhancing investment and economic growth.

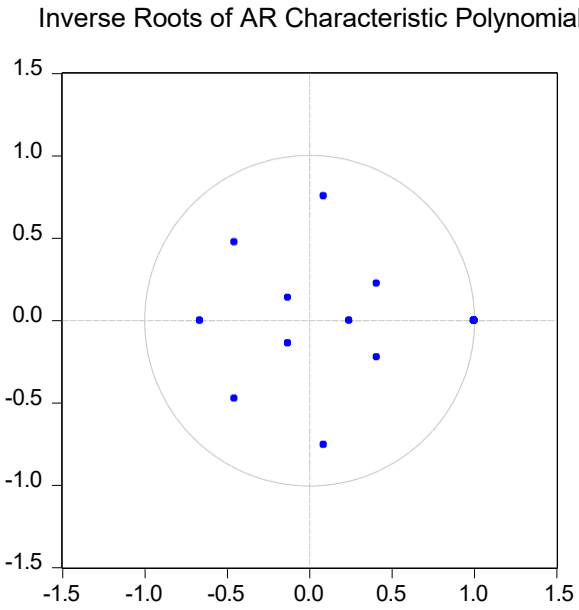
4.5 Stability Test Results

To ensure the reliability of our Vector Error Correction Model (VECM), it is essential to examine its stability. A stable VECM implies that the estimated relationships among the variables are consistent over time and that the system does not exhibit explosive behaviour, which could undermine the validity of the results. To assess the stability of our model, we employed the inverse roots of the autoregressive (AR) characteristic polynomial. This diagnostic test evaluates whether the estimated model satisfies the stability condition necessary for meaningful economic interpretation.

The key principle behind this test is that all inverse roots of the characteristic polynomial must lie within the unit circle. If any root falls outside the circle, it indicates instability in the system, suggesting that the model is mis-specified or that the underlying relationships among the variables may change over time. However, our findings confirm that all estimated roots are positioned well within the unit circle, providing strong evidence that the model is stable.The graphical representation of the inverse roots, displayed in the Figure

below, visually reinforces this conclusion by demonstrating that none of the roots exceed the boundary of the unit circle.

The stability of the VECM has significant implications for the robustness of our empirical findings. A stable model ensures that the estimated short-run and long-run relationships between investment, remittances, and other explanatory variables remain valid and can be reliably used for forecasting and policy recommendations. Moreover, it indicates that the adjustments toward long-run equilibrium, as captured by the error correction term, follow a predictable and consistent pattern over time.



In conclusion, the results of the inverse roots of the AR characteristic polynomial test affirm that our VECM satisfies the necessary stability conditions, enhancing confidence in the validity of our econometric analysis. This stability allows policymakers and researchers to draw meaningful inferences regarding the impact of remittances on investment and to formulate strategies that leverage remittance inflows for sustainable economic development.

5. Conclusion

Migrant remittances have emerged as one of the most crucial sources of external development finance, playing a vital role in supplementing domestic savings and fostering economic growth. As a stable and significant inflow of foreign exchange, remittances can serve as an alternative source of investment, contributing to capital formation and financial stability (Djajic, 1986; Quibria, 1996; Russell, 1986; Taylor, 1999; Taylor *et al.*, 1996).

This study has undertaken a comprehensive investigation into the relationship between inward remittance flows to India, investment, GDP, and other macroeconomic variables over the period from 1978 to 2015. The empirical findings suggest that all selected variables are integrated of order one, as confirmed by unit root and stationarity tests. The Johansen cointegration test establishes the presence of long-run equilibrium relationships among the variables, with the results indicating the existence of four cointegrating equations. This implies that remittance inflows, investment, and other economic indicators exhibit a stable and non-spurious long-run association.

Furthermore,the estimation of the Vector Error Correction Model (VECM) reveals that the coefficient of the error correction term (ECT) is both negative and statistically significant. This finding indicates that any short-run deviations from equilibrium are systematically corrected over time, reinforcing the notion that remittance inflows have a persistent and predictable influence on investment. The results also highlight the significant short-term positive impact of remittances on investment, underscoring the role of migrant earnings in capital accumulation and economic expansion.

Given the strong linkage between remittance inflows and investment, it is imperative for policymakers to devise strategies that encourage the formalization of remittance transfers. Ensuring that remittances are funnelled through official financial channels can enhance their contribution to productive investment ventures. To achieve this, policymakers should focus on strengthening institutional frameworks, improving financial infrastructure, and expanding access to banking services, particularly in rural and underserved regions.

Additionally, measures should be implemented to curb the use of informal remittance channels and unauthorised financial intermediaries. Strengthening regulatory mechanisms and fostering financial literacy among migrant workers and their families can promote the effective utilisation of remittance earnings. By enhancing accessibility to formal financial services and investment opportunities, remittances can be better integrated into the financial sector, thereby contributing to broader economic development and long-term financial stability.

In conclusion, this study reaffirms the crucial role of remittances in shaping investment dynamics and economic growth in India. A well-structured policy framework that facilitates the efficient utilisation of remittance inflows can unlock their full potential as a driver of sustainable development. Future research

may further explore the sectoral impact of remittances, examining their role in fostering entrepreneurship, human capital development, and infrastructure investment, thus offering deeper insights into maximising their developmental benefits.

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