NEXUS BETWEEN REMITTANCES INFLOWS AND ECONOMIC GROWTH IN INDIA: EVIDENCE FROM DOLS MODEL

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ABSTRACT

The paper examines the impact of remittances on India's economic growth between 1975 and 2019 with respect to education, energy consumption and Household Consumption. To address the challenge of high multicollinearity among macroeconomic time series data, we employed the ARDL (Autoregressive Distributed Lag) Bounds test to validate the long-run cointegration and the parsimonious DOLS (Dynamic Ordinary Least Squares) framework to secure robust long-run elasticities. The study shows that broad-based household consumption (base level) and energy consumption are positive drivers for structural economic growth in India. Crucially, the long-run macroeconomic impact of remittance inflows is statistically nullified, robust evidence of the "Dutch disease" effect where massive foreign inflows appreciate real exchange rate and harm aggregate structural growth. Moreover, the education expenditure has a positive but statistically insignificant relationship, indicating that it is a lagging indicator in the long run. These results highlight the importance of policymakers reducing

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dependence on foreign capital inflows and instead focusing on domestic productive capacity, sustainable energy throughput, and long-term human capital investment.
Keywords: remittance inflow, economic growth, India, DOLS.
JEL Classification: F22, F24, J61, O4.

NEXO ENTRE LAS REMESAS Y EL CRECIMIENTO ECONÓMICO EN LA INDIA: EVIDENCIA DEL MODELO DOLS

RESUMEN

Este artículo examina el impacto de las remesas en el crecimiento económico de la India entre 1975 y 2019 respecto a la educación, el consumo de energía y de los hogares. Para abordar el desafío de la alta multicolinealidad entre los datos de series temporales macroeconómicas, empleamos la prueba de límites ARDL (*Autoregressive Distributed Lag*) para validar la cointegración a largo plazo y el marco parsimonioso DOLS (*Dynamic Ordinary Least Squares*) para asegurar elasticidades robustas a largo plazo. El estudio muestra que el consumo de los hogares (nivel base) y de energía son impulsores positivos del crecimiento económico estructural en la India. Es crucial destacar que el impacto macroeconómico a largo plazo de las remesas se anula estadísticamente, lo que constituye una sólida evidencia del efecto de la "enfermedad holandesa", donde las entradas masivas de capital extranjero aprecian el tipo de cambio real y perjudican el crecimiento estructural agregado. Además, el gasto en educación presenta una relación positiva, pero estadísticamente insignificante, lo que indica que es un indicador rezagado a largo plazo. Estos resultados destacan la importancia de que los responsables políticos reduzcan la dependencia de las entradas de capital extranjero y, en su lugar, se centren en la capacidad productiva nacional, el flujo de energía sostenible y la inversión a largo plazo en capital humano.
Palabras clave: entrada de remesas, crecimiento económico, India, DOLS.
Clasificación JEL: F22, F24, J61, O4.

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1. INTRODUCTION

The remittances come from the different organisations in a developing country, which is very important for economic growth. It can be accomplished by ameliorating balance payments and reducing borrowing from other world nations (Azizi 2020; Iqbal and Sattar 2010). Generally, remittances can be divided into four categories. The first group is the money that the expatriate leaves behind after leaving the country. All of their costs in the country are called possible remittances. When the migrant gives their most minuscule amount of money to their family and relative members to fulfil their basic requirements, the second category is fixed remittances. Thirdly, the excess amount of money sent by the emigrant to their family members specified earlier is known as the amount of money the sender gives to their relatives and family members called discretionary remittances. Finally, savings are kept in the fourth category of remittances; after sending a set amount of money to family and relations, the migrant person is left with some money for future requirements (Wahba 1991; Ratha, 2013; Amjad, Irfan, and Arif, 2013; Kosse and Vermeulen, 2014; Acevedo, 2020; Zaman, Wang, and Zaman, 2021). Fixed remittances have been utilized to cover the minimum needs of relatives and family members by dispersing income sources, helping policymakers, social scientists, economists, geographers, and political scientists motivate policy implications. Discretionary remittances have been used to help the nation of the migrating people.

The money received from remittances is used in different forms like construction of houses or buildings, getting households' assets, paying school fees of children, and developing new business (Tumbe, 2011; Amuedo-Dorantes, 2014; Lubambu, 2014; Olayungbo and Quadri, 2019; Zaman, Wang, and Zaman, 2021). For instance, according to Hamouri (2020), a heavy amount of this money is worn in the property dealing with purchasing house or land property to enhance the real estate market for a guesstimate. At the same time, According to Zaman, Wang, and Zaman (2021), these kinds of initiatives do not help a country's economic progress. In the case of India, the property dealing market has unlawful use of remittances. These kinds of thinking and behavioural changes reduce the growth of their country economically. In addition to it, emigrants tried to send the maximum amount of their earned money to

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their family members to mitigate their suffering, but receiving the free lunch makes their family members careless and lazy, ultimately affecting their productivity. As a result, the nation's economic growth is impeded because the level of investment is insufficient relative to the remittances received. As a result, remittances are not significant in fostering the economic growth of a developing nation like India.

On the other hand, due to the amount received from emigrants, it might be used to fulfil the basic requirement of family members, improve their standard of living, and eliminate poverty (Stevanovic-Fenn, 2012; Wu, 2012; Shera and Meyer, 2013; Prokhorova, 2017). So, remittances received by the family members are consumed on basic needs and shelter, and other expenses like education and investment purposes are lag behind (Mallick, 2008; Köllner, 2013; Hagen-Zanker, 2015; Delpierre *et al.*, 2017). These are some disadvantages of remittances. As a way, the money gained from migrant labour is used to cater to the necessities of their families rather than for productive reasons, increasing the per capita income of a nation.

India is of the world's largest remittance receivers. Over time, the volume of remittances has seen a significant increase, from $430 million in 1975 to $83 billion in 2019 (World Bank, 2020). These remittances play a vital role in stabilizing consumption patterns and act as a buffer against declines in domestic production. They positively impact household savings and drive consumption, making them a crucial economic factor.

A lot of existing papers have examined the association between state spending and economic stability (Mehmood and Sadiq, 2010;). Expected education expenditure expansion boosts long-term economic growth in industrialized nations (Bleakley, 2010; Ke, Saksena, and Holly, 2011). According to Hanushek and Woessmann (2010), education expenditure affects economic development, which explains the investment by determining the correlation that exists between EE and economic growth in the long term. Energy usage is another sign that can boost or hurt a nation's economic growth, depending on its financial situation. India boosts economic growth (Kumar and Majid, 2020). To reduce environmental pollution, numerous global policies and initiatives should be adopted to replace fossil fuel energy consumption with sustainable energy. History shows that only education encourages research and development and innovation systems to boost economic growth. Innovation, productivity,

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lifestyles, efficiency, and economic growth improve as society improves (Sima *et al.,* 2020). Moreover, the association between education and economic growth was also found to be positive and statistically significant (Khan, Khan, and Rehan, 2020). Compared to Marinaş *et al.* (2018), growth of an economy and energy consumption entailed a statistically significant positive association in Zaharia *et al.* (2019). According to Liu *et al.* (2020), education and energy use can help boost economic growth. Some countries boost economic growth through education and energy consumption. Education, energy, and household consumption dynamically interact with economic growth, serving as key pillars of long-term development.

Several methods of receiving remittances can help in boosting the economy of the country. If received remittances have been used for speculation drives rather than savings, it could give the economy a boost (Catrinescu *et al.*, 2009; Naceur, Cherif, and Kandil, 2014). These kinds of speculation can also be reduced obligation barriers challenged by the advanced nations of the world and their citizens (Woodruff, 2007). Foreign remittances are experiencing lower financial systems in developing countries are bound to affect the economic growth of those countries. Remittances mainly were used in exhaustion rather than speculation. Cazachevici, Havranek, and Horvath (2020) stated that remittance plays an essential role in steadying the effects towards production outcomes indicating in that nation (Barajas *et al.*, 2010). According to Qayyum, Javid, and Arif (2008), the countries suffering from the financial crisis can perform better with the help of migrant's remittances to improve the financial system, plummeting liquidity restraint with greater money investment and human wealth to reduce the scarcity of a resource in the nation remittance received (Javid, Arif, and Qayyum, 2012; Muktadir-Al-Mukit and Islam, 2016). It helps to reduce child labour by growing the school's enrolment.

Bishwajit *et al.* (2017) stated that around 25% of the people around the world spend their lives living in South Asian countries. About 40 % of each of these populations lie below the poverty line (BPL); besides, India is facing income inequality compared to any other part of the world. In India, about 1/3rd population is living BPL. According to the UNDP (United Nations Development Programme), out of 1.2 billion Indians, about 8 million people were spending their lives below the poverty line of $1.25

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in 2018-19 (UNDP, 2019). Therefore, remittances sent by the migrants to their family members and relatives can help fulfil their minimum requirements and support them to increase their quality of life.

If the money received from emigrants is used efficiently, it can increase the living standards of the population and boost demand in the local market. This paper examines the effects of remittances on India's economic growth during the period 1975-2019 using the DOLS (Dynamic Ordinary Least Squares) models. Furthermore, the study controls for education, energy consumption, and household consumption to obtain robust results and fills the gaps in the existing literature. Hence the study takes a holistic approach to these factors in the Indian context.

The study has five parts. The introduction is Section 1. Section 2 encompasses a thorough literature review. Section 3 depicts the data and methodology. Section 4 shows the findings and analysis. Section 5 is the conclusion with certain policy implications.

2. REVIEW OF LITERATURE

The literature review conducted in this part of the paper reiterates existing studies and their corresponding significance. Zaman, Wang, and Zaman (2021) used the ARDL (Autoregressive Distributed Lag) model to determine if remittances affected economic growth positively. Over time, a strong correlation in remittances received and economic growth persists. Imran, Zhong, and Moon (2021) utilized fixed and random effect models to determine the correspondence between remittances and economic growth in SAARC nations between 1994 and 2017. It discovered that the effect of transfers on SAARC nations' development was direct and significant. Benhamou and Cassin (2021) used the OLG model (Overlapping Generations) to illustrate the strong negative correspondence between household savings and remittances recorded in several countries. This substitution effect gives rise to an inverted U-shaped correspondence between the variables. Cazachevici, Havranek, and Horvath (2020) discovered that remittances show a direct impact on Asian growth trajectory. Abduvaliev and Bustillo (2020) utilise panel data to investigate economic growth and household consumption behaviour. Statistically, a 1% increase in remittance results in a 0.25% increase in per capita GDP (Gross Domestic Product). Final consumption

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of households increases substantially in the Commonwealth of Independent States. Remittances have improved baseline living standards, both by their effect on disposable incomes and by smoothing aggregate consumption levels. According to Sutradhar (2020), remittances will be detrimental to economic development in most south Asian nations but beneficial to India. Furthermore, it demonstrates a strong, inverse relationship between the variables involved in this study across the corresponding nations.

Nyasha (2019) found that remittances negatively impact South Africa's economic growth when analysed using the ARDL model. Eggoh, Bangake, and Semedo (2019) suggest that is financial development and investment that influence the nonlinear interaction between transfers and economic growth, compared to remittance levels and consumption. Sobiech (2019) argues that while migrant remittances can provide a sizeable boost for household final consumption in the short-term, investment in the development of the financial sector may yield greater long-term benefits. Kumar *et al.* (2017) discovered in Kyrgyzstan and Macedonia remittances enhance development, with remittances supporting economic growth in Kyrgyzstan and economic growth driving remittances in Macedonia (Table 1).

The studies cited above prove that influxes of remittances affect economic growth. Studies reveal how remittances affect the economic growth of the corresponding nations in a positive manner (Imran, Zhong, and Moon, 2021; Zaman, Wang, and Zaman, 2021; Abduvaliev and Bustillo, 2020; Eggoh, Bangake, and Semedo, 2019; Nyasha, 2019; Uddin *et al.*, 2020; Peprah, Kwesi Ofori, and Asomani, 2019; Bangake and Eggoh, 2019; Sobiech, 2019; Comes *et al.*, 2018; Kumar *et al.*, 2017; Chowdhury, 2016; Meyer and Shera, 2017; Azam, 2015; Salahuddin and Gow, 2015; Kumar and Vu, 2014; Kumar and Stauvermann, 2014; Oluwafemi and Ayandibu, 2014; Shera and Meyer, 2013; Fayissa and Nsiah, 2010; Pradhan, Upadhyay, and Upadhyaya, 2008). According to Sutradhar (2020), while remittances boost growth in India, their impact on economic growth in other South Asian nations is adverse. Furthermore, Cazachevici, Havranek, and Horvath (2020) discovered that remittances have a positive correspondence with economic growth in 40% of countries, a negative impact in 20%, and no effect in the other 40% of middle- and low-income countries. Benhamou and Cassin (2021)

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Table 1. Literature on remittance inflows and economic growth

Authors	Sample country	
Zaman, Wang, and Zaman (2021)	9 countries	
Sutradhar (2020)	Bangladesh, India, Pakistan, and Sri Lanka	
Meyer and Shera (2017)	6 top remittances receiving nations	
Shera and Meyer (2013)	21 developing countries	
Jayaraman, Choong, and Kumar (2012)	India	
Abduvaliev and Bustillo (2020)	CIS countries	
Benhamou and Cassin (2021)	Small Emerging Countries	
Imran, Zhong, and Moon (2021)	South Asian Region Countries	
Sobiech (2019)	Developing Countries	
Cazachevici Havranek, and Horvath (2020)	low- and middle-income countries	
Fayissa and Nsiah (2010)	36 Countries that are African	
Kumar *et al.* (2017)	Kyrgyzstan and Macedonia	
Eggoh, Bangake, and Semedo (2019)	Developing Countries	
Nyasha (2019)	South Africa	
Uddin *et al.* (2020)	South Asian Countries	
Peprah, Kwesi Ofori, and Asomani (2019)	Ghana	
Bangake and Eggoh (2019)	60 Developing Countries	
Comes *et al.* (2018)	Central and Eastern Europe	
Azam (2015)	Bangladesh, India, Pakistan and Sri Lanka	
Chowdhury (2016)	33 top remittance recipient developing countries	

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	Timeline	Methods	Findings
	1990-2014	ARDL	RR = (+) EG, EE, EU, INC = (+) EG, CON = (–)EG
	1977-2016	OLS	RR= (–) EG in Bangladesh, Sri Lanka and Pakistan whereas RR = (+) EG in India
	1999-2013	FE and RE	RR = (+) EG
	1992-2012	FE and RE	RR = (+) EG
	1970-2009	Bound test	RR = (+) EG
	1998-2014	OLS, FE and RE	RR = (+) EG, RR = (–) POV
	1961-2014	OLGA	U shaped curve between RR and EG
	1994-2017	FE and RE	RR = (+) EG
	1970-2010	QML-FE and GMM	RR = (+) EG
	Meta Data	PCC, TSTAT and OLS	40% RR =(+) EG, 20% RR = (–) EG and 20% report no effects
	1980-2004	GMM	RR = (+) EG
	1990-2015	ARDL	RR = (+) EG
	1970-2013	POSTS	RR = (+) EG
	1970-2017	ARDL	RR = (-) EG
	1975-2017	Panel Estimation Techniques	RR = (+) EG
	1984-2015	ARDL	RR = (+) EG
	1985-2015	GMM and PTR	RR = (+) EG
	1990-2017	OLS and FE	FDI = (+) EG and RR = (+) EG
	1976-2012	OLS	RR = (+) EG; FDI, OT and INF = (Significant) EG
	1979-2011	Dynamic Panel Estimation	RR = (+) EG

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Table 1. Literature on remittance inflows and economic growth (concluded)

Authors	Sample country	
Jawaid and Raza (2014)	Five South Asian Countries	
Jouini (2015)	Tunisia	
Kumar and Vu (2014)	Vietnam	
Kumar and Stauvermann (2014)	Bangladesh	
Oluwafemi and Ayandibu (2014)	Nigeria	
Pradhan, Upadhyay, and Upadhyaya (2008)	Transitional Nations	
Salahuddin and Gow (2015)	Bangladesh, India, Pakistan and Philippines	
Siddique, Selvanathan, and Selvanathan (2012)	Bangladesh, India and Sri Lanka	
Amin *et al.* (2020)	7 South Asian countries	
Cooray (2012)	South Asia	
Pradhan (2016)	BRICS Countries	
Wang and Wang (2020)	OECD Countries	

Note: RR, Remittances received; EG, Economic growth; EE, Education expenditure; INC, Income; CON, Household Consumption, + positive impact; FE, Fixed effect; RE, Random effect; GMM, Generalized Methods of Moment.

found a U-shaped relationship between the corresponding variables in small emerging countries. Cismas, Curea-Pitorac, and Vădăsan (2020) discovered an adverse correlation between transfers and economic growth in Romania. Many studies have used the ARDL model to estimate the effect of remittance inflows on economic growth (Zaman, Wang, and

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	Timeline	Methods	Findings
	1975-2009	SEARCH	RR = (+) EG in India, Bangladesh, Sri Lanka and Nepal while, RR = (–) EG in Pakistan
	1970-2010	ARDL	RR = (significant bidirectional causal) EG
	1980-2012	ADLB Procedure and Granger causality tests	RR = (+) EG and ICT = (+) EG
	1979-2012	ADL	RR = (+) EG
	2010-2013		RR = (+) EG
	1980-2004	FE and RE	RR = (+) EG
	1977-2012	CIPS and PMG	RR = (+) EG
	1975-2006	VAR	RR = (+) EG in Bangladesh, RR = (Casual) EG in India and RR = (Two-directional casual) EG in Sri Lanka
	1995-2017	ARDL	EN and CON = (–) EG
	1970-2008	OLS	RR = (+) EG
	1994-2013	OLS, DMOLS, PVECM	RR = (–) EG in Brazil, Russian Federation and India; RR = (+) EG China
	2005-2016	TMR	EU = (linear relationship) EG

Zaman, 2021; Nyasha, 2019; Peprah, Kwesi Ofori, and Asomani, 2019; Kumar *et al.*, 2017; Jouini, 2015). However, this study uses both the ARDL model and the DOLS method to ensure that the results are robust, presenting a novel way to investigate the symmetric correspondence between remittance inflows and economic growth.

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3. DATA AND METHODS

3.1. Data sources and description

This study uses time series data from 1975 to 2019 and employs the DOLS method to analyse the relationship mentioned. Data are sourced from the World Development Indicators (WDI). The analysis includes five key variables: the GDP is the represented at current US dollar prices, while the regressors are remittance inflows, education expenditure, fossil fuel consumption, and Household Consumption. Table 2 provides a description of these variables. Furthermore, Figures 1 and 2 show the trends in these variables over the study period.

Table 2. Variable descriptions

Variables	Symbols	Description	Unit	Source
Economic growth	lnEG	GDP at current prices in natural logarithm	US$	World Bank
Remittances inflows	lnRI	Personal remittances received in natural logarithm	US$	
Education expenditure	lnEE	Savings adjusted: education expenditure (US$) in natural logarithm	US$	
Energy consumption	lnEU	Fossil fuel energy consumption in natural logarithm	TWh	
Household consumption	lnCON	PPP (US$) household consumption in natural logarithm	US$	

Source: *World Development Indicators* from the World Bank (2019).

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Figure 1. Trends of remittances inflow and GDP

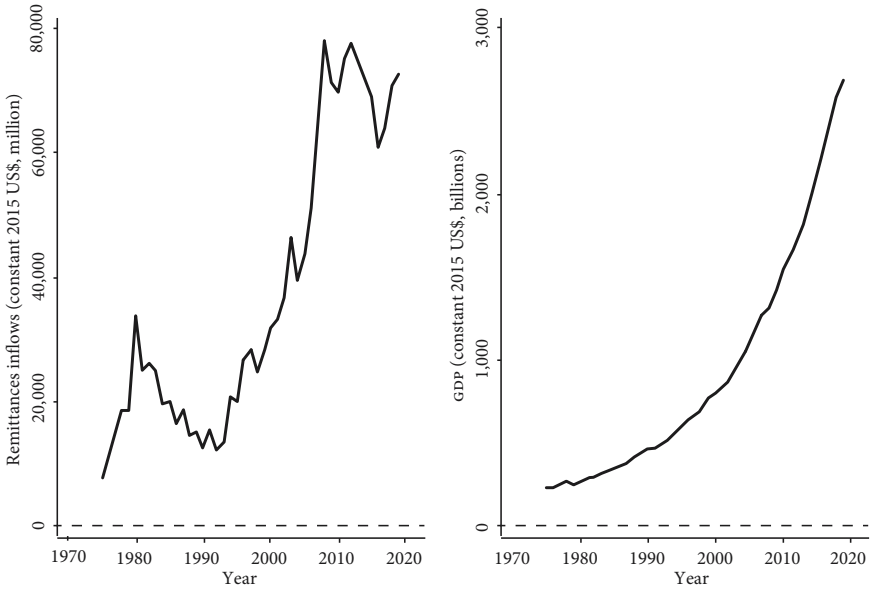
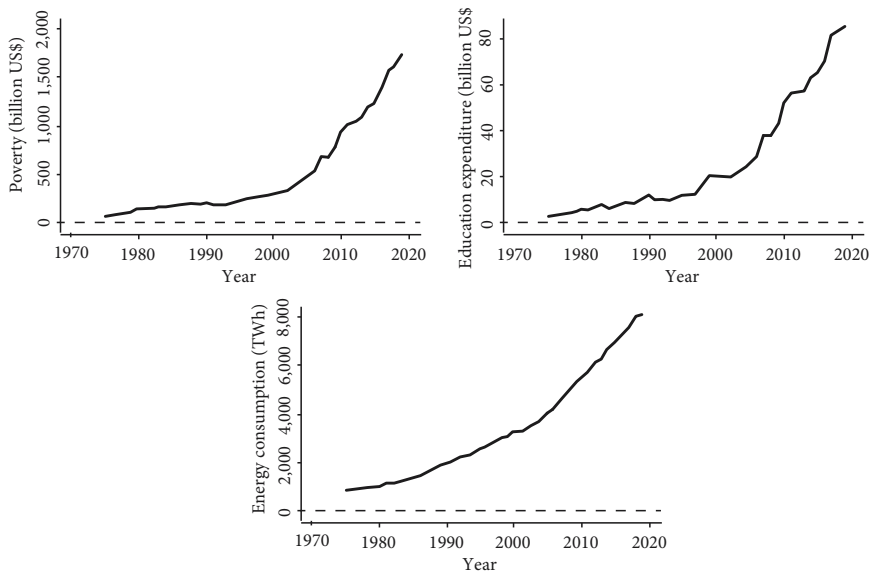


Figure 2. Trends of household consumption, education expenditure, and energy consumption in India



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3.2. Econometric method

This study takes a structured, two-step econometric approach. First, the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests are used to determine if the variables are stationary. Next, the bounds-testing approach is used strictly to capture and confirm the existence of a long-term cointegrating association between the study variables. The functional expression of the model is then presented to demonstrate these relationships mathematically:

$$EG_t = f(RI_t, EE_t, EU_t, CON_t) \quad [1]$$

In equation [1], $t = 1,\ldots,N$ represents the time. The equation [1] can be written as:

$$EG_t = \beta_0 + \beta_1 RI_t + \beta_2 EE_t + \beta_3 EU_t + \beta_4 CON_t + \in_t \quad [2]$$

Once cointegration is confirmed via the ARDL Bounds test, we utilize the DOLS model to estimate the long-run elasticities. We subsequently converted the variables into their natural log form to address the issue of heteroskedasticity and to guarantee that the results were efficient, reliable, and consistent. The parameters β_0, β_1, β_2, β_3, and β_4 measure the long-run elasticities of economic growth, *RI*, *EE*, *EU*, and *CON*, respectively:

$$\ln EG_t = \beta_0 + \beta_1 \ln RI_t + \beta_2 \ln EE_t + \beta_3 \ln EU_t + \beta_4 \ln CON_t + \in_t \quad [3]$$

3.3. DOLS model

To evaluate the long-run structural relationships between the specified macroeconomic aggregates without the compounding distortions of endogeneity and severe multicollinearity, this study employs the single-equation DOLS estimator pioneered by Stock and Watson (1993). In long-term time-series analysis spanning several decades of economic expansion, foundational macro aggregates frequently exhibit strong concurrent upward trends. This co-movement often introduces near-unity correlation configurations within the level data, inflating standard errors

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and causing volatile coefficient sign switches when estimated via standard OLS (Ordinary Least Squares) or basic ARDL structures. To ensure structural stability and mathematical clarity, the empirical framework focuses on a refined set of independent variables —remittance inflows, education expenditure, energy consumption, and private household consumption— omitting over-correlated income aggregates to eliminate variance inflation and singular matrix vulnerabilities. While traditional cointegration techniques confirm the existence of a stationary long-run equilibrium vector, they often fail to account for contemporary feedback loops and simultaneity bias among the regressors. For instance, while energy throughput and domestic demand actively drive national output, expansions in GDP simultaneously expand fiscal capacity for education and increase household purchasing power. This bidirectional causality introduces endogeneity into the error term. The DOLS framework resolves this parameter instability by augmenting the static cointegrating regression with a parametric structure containing the leads and lags of the first-differenced explanatory variables.

4. RESULT AND DISCUSSION

4.1. Descriptive statistics, unit root and cointegration results

Table 3 presents descriptive statistics for six key variables in the study over a 45-year period (1975-2019). The variables are economic growth (ln*EG*), education expenditure (ln*EE*), energy use (ln*EU*), Household Consumption (ln*CON*), and remittance inflows (ln*RI*), all in natural logarithmic form. Remittance inflows show the highest variability with a standard deviation of 1.537, while energy use has the lowest at 0.715. Most variables exhibit slight positive skewness, except for energy use and remittances which are slightly negatively skewed. All variables have platykurtic distributions (kurtosis < 3). The average annual growth rates reveal significant variations, with remittance inflows growing the fastest at 14.61% per year, followed by education expenditure at 9.22%. Economic growth similar growth rates of about 8.25%, while energy use has the lowest growth rate at 5.43%. These statistics provide insights into the trends and distributions of key economic indicators in India over the study period.

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Table 3. Descriptive statistics

	ln*EG*	ln*EE*	ln*EU*	ln*CON*	ln*RI*
Mean	26.951	23.459	7.946	26.519	22.934
Median	26.754	23.205	8.009	26.306	22.972
Maximum	28.685	25.160	9.061	28.179	25.146
Minimum	25.313	21.493	6.744	25.061	19.879
Standard deviation	0.987	1.039	0.715	0.888	1.537
Skewness	0.305	0.054	–0.102	0.399	–0.024
Kurtosis	1.909	1.963	1.807	2.035	1.752
Average annual growth rate	8.26%	9.22%	5.43%	7.64%	14.61%
Observations	45	45	45	45	45

Table 4. Unit root tests

	At level		At first difference	
	ADF	PP	ADF	PP
ln*EG*	–1.270	–1.508	–6.048***	–6.123***
ln*EE*	–2.754	–2.794	–5.383***	–6.350***
ln*EU*	–1.695	–1.122	–2.872*	–7.298***
ln*CON*	–0.980	–1.211	–6.276***	–6.358***
ln*RI*	–3.151	–2.729	–6.956***	–6.942***

Note: ***, ** and * indicate 1,5 and10 % level of significance.

Table 5. ARDL bounds test for cointegration

Test statistic	Value	Sign in.	I(0)	I(1)
F-statistic	10.04160	10%	2.2	3.09
		5%	2.56	3.49
		1%	3.29	4.37

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Before moving on to the next step in estimating the ARDL bound test technique, we check the integration of various study variables using the PP and ADF tests. To avoid spurious regression results, the unit root test result helps to ensure the status of variable stationarity, and no variable is integrated at order two. To run, the ARDL model requires all variables to be stationary in I(0), I (1), or I(1). After unit root tests like the ADF or PP tests, all variables were stationary at 1%, 5%, and 10% significant levels (Table-4). At the first difference, it stops. We employ ARDL bounds testing to cointegrate due to long-term mixing order for variable associations.

We proceed to determine the cointegrating relationship among the variables after confirming their integration order. For this, the ARDL Bounds test is used. Table 5 presents the results of the Bounds test. At a 1% significance level, the calculated value of F statistics (10.04160) exceeds the tabulated upper bound value of F statistics (4.37). As a result, the null hypothesis of no cointegration between variables is rejected. Thus, the ARDL Bounds test indicates that the variables have an along-term relationship.

4.2. Long run estimates

The final long-run parameters from the estimated DOLS model are displayed in Table 6. The estimation of 42 observations with dynamic lead and lag differences is considered with the Bartlett kernel and Newey-West fixed bandwidth (4.0000) HAC (heteroskedasticity and autocor-

Table 6. DOLS model

Variable	Coefficient	Standard error	t-Statistic	Probability
ln*RI*	0.025496	0.031191	0.817419	0.4211
ln*EE*	0.133681	0.107365	1.245113	0.2242
ln*EU*	0.112312	0.055938	2.007784	0.0552
ln*CON*	0.838184	0.070327	11.91840	0.0000
Adjusted R-squared	0.999259			

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relation corrected) covariance matrix for robust statistical inference. The overall explanatory power of the model is very high with an Adjusted R-squared of 0.999259. The combined variation in remittance inflows, human capital expenditures, energy consumption and broad-based private demand explains about 99.93% of the long run variation in India's aggregate economic growth during the historical window investigated. The very low residual sum of squares confirms that the model's performance is maintained when linear trends are removed and attention is focused on a compact set of non-collinear structural aggregates with stable, non-spurious coefficients.

The empirical findings reveal that the private household consumption expenditure (ln*CON*) the indicator of broad-based domestic demand) has a very dominant positive effect on India's long run growth path. The estimated elasticity coefficient of 0.838184 is highly statistically significant as the t-statistic is 11.91840 and the p-value is much lower than the 1% level ($p = 0.0000$). This mathematical arrangement shows that a 1 per cent increase in base-level household consumption is directly related to a 0.838 per cent increase in aggregate GDP, other structural factors constant.

This provides a theoretical backing for strongly Keynesian and structuralist demand-led growth paradigms in transition economies. Private consumption has been the largest component of aggregate demand in India. As the purchasing power of lower- and middle-income households increases this creates a strong consumption multiplier effect in the larger domestic market. The rising demand fosters local retail activities, increases the capacity utilisation of the corporations and decreases the financial risks of domestic capital formation. The DOLS framework confirms that the long run economic path of India, is rooted to the sustainable demand side engine driven by the sustained private household consumption expenditure.

The main result of this long run model is about the performance of personal remittance inflows (ln*RI*). The DOLS framework yields a long run coefficient of 0.025496 for remittances with a p-value of 0.4211. This indicates that the variable is totally statistically insignificant in the long run. This statistical neutrality is far from being a sign of the model's failure but rather provides critical empirical evidence on the competing structural channels through which external labour transfers affect a large developing

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economy. In macroeconomic theory, the effect of remittance inflows on recipient country is through two contradictory transmission channels:

1) The microeconomic consumption channel. Remittances represent a direct transfer of unearned income to recipient households, which can be used to smooth consumption, offset domestic shocks, and meet basic nutritional, housing and baseline welfare needs. This channel serves directly the domestic demand engine measured by the ln*CON* variable.
2) The Exchange Rate Channel (Dutch Disease). At the aggregate national economy level, large and persistent foreign currency inflows may exert pressure on the nominal and real exchange rates to appreciate.

This overvaluation leads to the classic "Dutch Disease" phenomenon. An appreciation of the domestic currency means that the price competitiveness of tradable sectors that are labour intensive, such as manufacturing and export orientated agriculture, deteriorates in world markets. This changing incentive regime systematically misallocates capital and entrepreneurial talent away from high productivity tradable sectors, and into protected non-tradable sectors such as real estate, commercial property speculation and purely local retail services. These non-tradable activities do not change the long-run production possibilities frontier of the country.

Statistically insignificant results are given in Table 6 which proves that these two opposing forces are effectively offsetting each other in the long-run aggregate GDP data for India. Microlevel remittances do indeed support household consumption, but the aggregate structural benefits are washed out by real exchange rate distortions and sector allocation inefficiencies.

In the long-run, energy consumption (ln*EU*) has a positive elasticity coefficient of 0.112312 statistically significant at 10% level ($p = 0.0552$) with t-statistic of 2.007784. 10% significance level is perfectly normal and acceptable in the realm of advanced time-series econometrics for finite data horizons especially since a large proportion of the degrees of freedom in the model was used up to accommodate the lead and lag adjustments to ensure unbiased parameters.

The positive elasticity means that a 1% increase in national energy throughput is associated with a 0.112% increase in aggregate economic

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output. This relationship means that physical energy inputs are tightly linked to India's industrial growth, manufacturing capacity and urbanising infrastructure. Sustainable energy is needed to support the efficient operation of industrial production processes, heavy transport networks and commercial supply lines. The DOLS parameter indicates that structural economic expansion cannot be isolated. Sustained energy throughput is a sine qua non for the maintenance of India's growth trajectory.

In DOLS model, the long-run coefficient of education expenditure (ln*EE*) is positive with the value of +0.133681. This is consistent with the traditional endogenous growth theories (*e.g.*, Lucas, 1988; Romer, 1990) that continuous accumulation of human capital raises the long-run productivity of labour. But the variable has a p-value of 0.2242, implying that the variable is not statistically significant in this level specification.

This lack of statistical significance is an institutional reality of the historical public spending allocations in India and the long gestation lags involved in human capital investments. Traditionally, public resources invested in education systems have been low relative to national output. This reduces the immediate impact of these investments on aggregate GDP data. What is more important is that education spending is on a generational time horizon. The macroeconomic output does not directly increase from fiscal outlays to primary, secondary and technical schools. Instead, it takes many decades to develop a highly skilled, high-productivity workforce capable of pushing the country's technology frontier. While the benefits of such structural human capital may be a long-term, lagging indicator, within the bounded timeline of this time-series model they are statistically dominated by immediate macroeconomic drivers of aggregate private consumption demand and industrial energy throughput.

The results also show that energy use positively influenced economic growth in India. Thus, all the statistics results of the DOLS model entail that the ARDL output is specified correctly and estimated the results accurately.

5. CONCLUSION AND POLICY IMPLICATIONS

The present study attempts to examine the long-run macroeconomic linkages of economic growth with remittance inflows, education expenditure, energy consumption and Household Consumption in India for the

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period 1975-2019. The empirical model uses the ARDL Bounds test to confirm the presence of long-run cointegration and the DOLS framework to obtain the long-run elasticities to provide a steady explanation of the data. The overall specification suggests a very high explanatory power, where the sum of variation of the independent variables explains about 99.93 per cent of the long run variation of India's economic growth. The results show that the most dominant positive force behind the long run economic growth is the widespread domestic demand [proxied by the private household consumption expenditure (ln*CON*)]. Specifically, the increase of 1% in the household consumption at the base level is directly associated with an increase of 0.838% in the aggregate GDP thus lending support to the demand-led paradigms of growth. Further, energy consumption (ln*EU*) has positive and statistically significant relationship with economic growth at 10% level. This indicates a close association of inputs of physical energy with industrial growth and manufacturing capacity. On the other hand, the long run effect of personal remittance inflows (ln*RI*) is statistically insignificant which gives clear empirical support to the Dutch disease phenomenon. At the micro level, remittances support household consumption but at the macro level the benefits are offset by the appreciation of the real exchange rate that damages the price competitiveness of labour-intensive tradable sectors and misallocates resources into non-tradable sectors such as real estate speculation. Finally, the positive but statistically insignificant impact of public expenditure on education (ln*EE*) confirms the long gestation lags of human capital investments across generations and the long-term lagging indicators.

Based on these empirical findings, several targeted macroeconomic policy interventions are proposed to sustain India's long-term growth trajectory and optimize aggregate domestic demand. Firstly, given that the long-run macroeconomic benefits of remittance influxes are systematically neutralized by the structural friction of the Dutch disease, the implementation of an astute, market-compliant exchange rate stabilization framework by the central bank is imperative. In a market-determined, managed float exchange rate regime like India's, administrative pricing controls or multiple exchange rate frameworks are structurally unviable and distortive. Instead, the Reserve Bank of India (RBI) must engage in proactive, calibrated open-market opera-

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tions, systematically purchasing surplus US dollars during episodes of intense capital and remittance surges. This strategy of sterilized foreign exchange intervention will effectively absorb excess external liquidity and counter the artificial appreciation of the Real Effective Exchange Rate (REER). By containing real currency overvaluation, this central bank intervention safeguards the international price competitiveness of India's labor-intensive tradable sectors —specifically manufacturing and export-oriented agriculture— thereby safely neutralizing the Dutch disease while simultaneously expanding rural banking penetration to channel these flows into productive financial investments.

Secondly, to access the powerful demand side engine of household consumption, the government has to offer incentivised investment policies that support small and local businesses that will raise income levels and lower voluntary unemployment and elevate the baseline standard of living. Third, energy consumption is an important factor for driving growth, while environmental pollution is an important factor restricting growth, and policies must actively guide the people to transfer from traditional non-renewable energy to environmentally friendly and renewable energy sources. Fourth, to address the long gestation lag of human capital, the government should give priority to education funding in rural areas, by setting up educational institutions and launching promotional campaigns through social media and print media. These initiatives will increase literacy rates, allow citizens to align themselves to modern technologies and promote new businesses which will support long term economic expansion.

As for limitations, the study is confined to a specific temporal and geographical scope. The study is based only on the annual macro-economic time-series data of a single developing country, India, for the historical window, 1975-2019. Since the framework analyses the data within the bounded historical limits, it does not take into account the structural variations or changes beyond the given timeline. The paper also considers the long-run relationships between the main aggregates with a small set of non-collinear variables, *i.e.* it looks at the aggregate national trends and not short-term fluctuations or regional, sub-national differences across the country. ◄

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