*Iranian Economic Review, 2024, 28(1), 49-77*
*DOI: 10.22059/ier.2024.339546.1007393*

*RESEARCH PAPER*

# Does Remittances Inflow in India Have Dutch Disease Effects? ARDL Cointegration Approach

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**Article History:** Received: 26 February 2022, Revised: 21 May 2022, Accepted: 19 June 2022
**Publisher:** University of Tehran Press.


## Abstract

Remittances are a great source of foreign exchange earnings for India as the country receives the highest amount of these inflows among other countries in the world. These inflows as they constitute a major part of the country's external inflows may have important implications on the macroeconomic variables of the country. In this paper, the main objective is to study the Dutch disease impact of remittances in the Indian economy. The Autoregressive Distributed Lag (ARDL) model is used for analyzing the Dutch disease impact of remittances using time series data from 1980-2019. The findings reveal that remittances do have a Dutch disease impact on the country by appreciating the real exchange rate and through contraction of the manufacturing sector of the country. The paper suggests that utilizing remittances in productive investment rather than on consumption can counter the side effects of remittances and will induce growth of both tradable and non-tradable sectors of the country.

**Keywords:** Autoregressive Distributed Lag, Export Competitiveness, Foreign Inflows, Real Exchange Rate, Time Series.
**JEL Classification:** E600, F100, F310, C32.

## 1. Introduction

Remittances are a major source of external financing for developing countries and can have many positive influences on the socio-economic development indicators of a country. For instance, remittances can positively impact on accumulation of human and physical capital, financial development, smoothing consumption level of households, and so on. However, an excessive inflow of remittances can also cause negative effects on the economy through appreciation of the real exchange rate and deterioration of the country's export competitiveness, which is termed the "Dutch Disease" phenomenon. The appreciation of the real exchange rate indicates an increase in the cost of producing tradable goods which causes problems in export

competitiveness. Theoretically, an increase in the inflow of foreign exchange earnings such as remittances causes an increase in households' disposable income. This leads to an increase in demand for both tradable manufacturing goods and non-tradable service sector goods. Increased demand for goods causes a rise in the price of non-tradable goods to clear the market but the price of tradable goods remains unchanged (since the price of tradable goods is determined in the international market). A rise in the price of non-tradables relative to the price of tradables leads to an appreciation of the real exchange rate; this is termed as spending effect of Dutch disease theory. The increase in the price of non-tradable encourages producers to expand the non-tradable sector, increasing in demand for labor in this sector. This excess demand for labor will lead to an increase in wages which will further intensify appreciation of the real exchange rate. The hike in wage rate will tend movement of labor from the tradable to non-tradable sector, which is termed as resource movement effect. The spending effect and resource movement effect hamper the competitiveness of the tradable sector inducing this sector to shrink. This phenomenon is called the "Dutch Disease" effect, the name coined by The Economist in 1977 to refer to the deteriorating effect of revenue generated from the discovery of natural gas in the Netherlands which affected the manufacturing sector of the country. With increased disposable income of households through the increased inflow of remittances may also result in a rise in imports, which will further hurt import-substituting industries. This is because due to real exchange rate appreciation foreign goods will now be cheaper than domestic goods hence imports may rise. Thus, a fall in exports and a rise in imports may create deficits in the current account balance of the country.

There is always surplus labor in developing countries like India. So, the resource movement effect may not be much pronounced in the case of such countries but there can be a spending effect that can lead to real exchange rate appreciation and lead to contraction of the tradable sector. This paper examines whether there are Dutch Disease effects of remittances in India. We study the Dutch Disease effects in India by examining the following two objectives:

a- Whether the inflow of remittances causes real exchange rate appreciation in the country (i.e. spending effect) and

b- How the composition of traded and non-traded goods sectors are affected by the inflow of remittances (i.e. resource movement effect).

The paper is organized in the following manner; section 2 reviews the extant literature on remittances and Dutch disease, section 3 illustrates the exchange rate system in India, section 4 mentions some of the stylized facts of the key variables taken in our

study, section 5 deals with model specification, section 6 deals with data description and source of data, section 7 deals with methodology of the study, section 8 analyzes the empirical results of the study, section 9 summarizes with the conclusion.

## 2. Literature Review

Barajas et al. (2010) in their IMF working paper used panel cointegration techniques for a sample of 79 countries of which 16 were low-income countries and 31 for low and middle-income countries for the period 1980-2007. They find that a consistent inflow of remittances does appreciate the real exchange rate but quantitatively the effects are very small. Hiroyuki Taguchi (2016) applied the VAR model to analyze the "Dutch Disease" effects of remittances in Bangladesh and Nepal. Dutch Disease refers to a situation in which a large inflow of foreign exchange earnings, say, from an export boom or increase in remittances or foreign aid leads to a reduction in export competitiveness by giving rise to real appreciation of home currency. The study found that there is no Dutch Disease effect in Bangladesh, on the other hand, it is present in Nepal. They conclude that the two contrasting results are from differences in demand patterns and policies of government for the development of manufacturing sectors. If the additional foreign exchange earnings are spent more on capital accumulation than on consumption spending, then in the long term there will be improvement in both tradable and non-tradable sectors. This is called as "capital accumulation effect" (Bourdet and Falck, 2006).

Lopez et al. (2007) indicated that remittances led to real exchange rate appreciation in their study for Latin American countries from 1990 to 2003. Uddin (2015) also found the same conclusion; he studied both the 'spending effect' and 'resource movement effect' associated with an increase in remittances. Using panel data for the five South Asian countries from 1975 to 2013, he found that remittances appreciate real exchange rates through spending effect and reduce the competitiveness of the export sectors by resource movement effect. Diushalieva (2019) in his studies for Commonwealth Independent States (CIS) over the period 2004-2018 found the same result of positive increase in real exchange rate due to remittances inflow.

In contrast to the above literature, Barrett (2011) using the OLS estimation technique for the Jamaican economy from 1995 to 2010 found that remittances do not lead to real exchange rate appreciation. Brahim et al. (2017) using the ARDL model for the MENA countries for the period 1980-2015 also found that remittances do not cause Dutch Disease effects in these countries. Rabbi et al. (2013) applying the Johasen cointegration and VECM model and using time series data of Bangladesh for the

period 1971-2011 found that remittance inflow is deteriorating countries' export competitiveness through real appreciation of the home currency in Bangladesh.

Eromenko (2016) found that remittances do not contribute to real exchange rate appreciation in Kyrgyzstan and Tajikistan because most of these increases in disposable income are spent on imported goods which depreciates the real exchange rate but there is a transfer of Dutch Disease effect from Russia to these two countries through the increase of oil price in Russia.

Nikas and Blouchoutzi (2014) studied Albania and Moldova over the period 1990-2010 and found contrasting implications for the two countries. Hien NP et al. (2019) in their investigation of Dutch Disease in Asian developing countries from 2006 to 2016 found that as remittances increase by 1%, real effective exchange rates increase by 0.103%. The study also finds that appreciation of REER is observable only in countries with low remittances to GDP ratio, as the ratio increases, there is depreciation of home currency. The rest of the findings were the countries with low export opportunities faced high appreciation of their currencies and the countries with floating exchange rate regimes faced no Dutch Disease. Shobande and Shodipe (2019) applying the Cochrane-Orcutt OLS model for South Africa find that remittances do not have any impact on the real exchange rate of the country. A time series analysis using the ARDL model in the case of India over the period 1980-2015, found that remittances have a positive impact on real effective exchange rates (Dutta and Sengupta, 2018). Saad Filho and Weeks (2013) argue that remittances positively impact on the balance of payment position, while Dutch Disease arises if the government fails to redirect those inflows into productive channels. Makhlouf and Mughal (2011) conducted IV Bayesian analysis using the Gibbs algorithm for Pakistan finds that remittances lead to Dutch Disease both in the long run and short run in the country. Ratha (2013) in his study of China, India, Mexico, Philippines and Lesotho found different results for individual countries. While Bourdet and Falck (2003) in their study for Cape Verde argue that domestic policies in favor of export growth, and directing the inflows in investment and saving channels can limit the effects of Dutch Disease.

From the literature review, it is evident that very few studies have been carried out regarding Dutch disease effects of remittances in the context of India. In addition to that, it is necessary to conduct individual country studies as different countries will have different impacts on the inflow of remittances depending on both the size of remittances inflow and the end use of these inflows. Therefore, this study is an individual country study using time series data for India to know about the

implications of remittances inflow in the country. The study will help policymakers to make suitable decisions based on the outcome of the study.

## 3. Theoretical Framework

Dutch disease refers to a situation in which extra wealth results from an export boom or large inflow of foreign currency such as foreign aid, remittances, and capital inflows leading to a contraction of other tradable activities by giving rise to a real appreciation of the domestic currency. The term was coined in 1977 by 'The Economist' to describe the decline of the manufacturing sector in the Netherlands after the discovery of the large Groningen natural gas field in 1959. The export boom of natural gas attracted a lot of foreign investment into the country and caused the appreciation of the Netherlands' currency. This has rendered many other areas of the economy uncompetitive. The Dutch disease theory was first time established by Corden and Neary in their seminal paper in 1982. According to the model, two effects are leading to Dutch disease and real exchange rate appreciation- the 'spending effect' and 'resource movement effect'. Bourdet and Falck (2006) added another channel which is, the 'capital accumulation effect', analyzing it from a long-term perspective. In the following diagram, the theoretical framework of Dutch disease, based on Corden and Neary (1982) and Bourdet and Falck (2006) is explained.

In Figure 1, the horizontal axis shows the non-tradable sector while the vertical axis shows the tradable sector. The curve P-P represents the initial transformation curve between the tradable and non-tradable sectors. Point A is an initial equilibrium point, where the transformation curve is tangential to the highest attainable social indifference curve (not drawn) and the slope of the curve which is the relative price of non-tradable to tradable, is fixed at that point. The transformation curve shifts upward to P-PF with the introduction of the capital inflows shown at point F, since the supply of non-tradable is constant and the availability of tradable expands with higher disposable income.

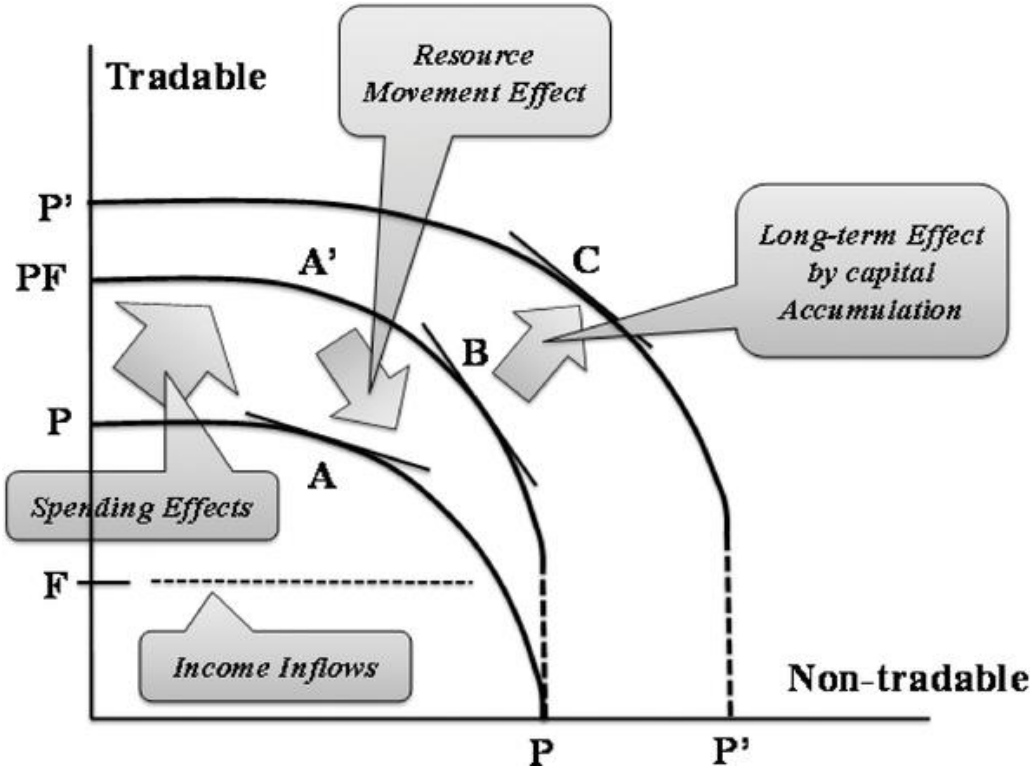


**Figure 1.** Theoretical Framework of 'Dutch Disease' based on Corden, Neary, Bourdet, and Falck.
**Source:** Taguchi (2016).

There would be excess demand for non-tradable with the unchanged relative price of non-tradable to tradable shown at point A' (new price line would be tangent to the rotated transformation curve at point A' with the same slope), if we assume positive income elasticity of non-tradable. The price of non-tradable, therefore, has to go up to clear the market, and the relative price of non-tradable to tradable also rises, since the price of tradable does not change as it is determined in the world market. This effect is referred to as an appreciation of the real exchange rate (spending effect). The rise of relative price, then, encourages the movement of production factors from the tradable sector to the non-tradable sector. This leads to expansion in the output of non-tradable and a decline in that of tradable from point A' to point B (resource movement effect).

Bourdet and Falck, from the longer-term perspective, considered the role of capital accumulation and argued that the transformation curve could shift further towards P'P' when an economy utilized capital inflows for domestic capital accumulation. As a

consequence, the relative price of non-tradable might be expected to fall from point B to point C, thereby facilitating the recovery of tradable sector. Thus, the 'capital accumulation effect' might offset or mitigate the economic damages caused by the original Dutch Disease effect.

To summarize, the basic theory tells us that capital inflows reduce export competitiveness through real exchange rate appreciation. However, in the longer term, due to capital accumulation, there would be an expansion of output in both tradable and non-tradable sectors.

## 4. Exchange Rate System in India

The exchange rate system in India has undergone a systematic change since Independence. From the system of the pegged exchange rate to the present form of market-determined exchange rate after liberalization in 1993.

After independence, India followed the par value system of the IMF whereby the external value of the rupee was fixed by the government to the UK pound sterling and gold. From 1971-1992, India was under the pegged regime where the value of the Indian rupee was pegged to the US dollar (1971-1991) and the pound sterling (1971-1975). After the breakdown of the Bretton Woods system and the collapse of the pound sterling, the value of the Indian rupee was pegged based on a weighted average of a basket of currencies of the major trading partners of India. The RBI determined the exchange rate within a band of plus or minus 5% of this weighted average. A major change occurred after 1991 when the Finance Minister announced the Liberalized Exchange Rate Management System (LERMS) in the budget for 1992-1993 in which there was partial convertibility of Indian rupee. In this system, 40% of the foreign exchange earnings were to be converted based on the official exchange rate, and the remaining 60% was based on the market-determined exchange rate. India adopted the market-based exchange rate in 1993, and the LERMS was removed from the budget in 1994. The RBI intervenes in the market only to reduce volatility and sudden appreciation or depreciation of Indian rupee. That is, India is under managed floating exchange rate regime since then.

## 5. Some Stylized Facts

Before describing the econometric model, a brief review of the historical trend of remittances inflow, real exchange rate, and output-employment trend of tradable and non-tradable sectors of India is reported below.

**5.1 Historical Trend of Remittances Inflow and Real Exchange Rate**

Figure 2 displays the trends of remittance inflows as a percentage of GDP. The average annual remittances receipts in India have been 23.3 billion for the period 1975-2019, where it stood at 83.3 billion in 2019 (FDI recorded at 50.6 billion in the same year). The trend of the real effective exchange rate (REER) is shown in Figure 3, where REER calculates the inflation-adjusted trade-weighted average exchange rate of India. The trend shows that the real exchange rate index with a base year value of 2015=100 has an upward trend from 1996 to 2019. However, the value of REER on average has remained around the base value with modest appreciation during 2016-19. Figure 4 decomposes the REER into NEER and effective relative price (ERP). ERP is the weighted average of price or inflation differential between the domestic country and the country's major trading partner. The figure shows that the appreciation of REER is mainly caused by an increase in the price differential of the country with major trading partners. In other words, the increase in the relative price of domestic goods vis-a-vis foreign goods led to the appreciation of REER. On the other hand, NEER has a downward trend (i.e. depreciation) over the years. One of the factors for this may be due to the current account deficit arising from the decline in exports' competitiveness (i.e. increase in effective relative price) of the country. However, the inflation differential has remained stable in recent years and this may be attributable to the formal adoption of the inflation targeting framework by RBI in 2016.

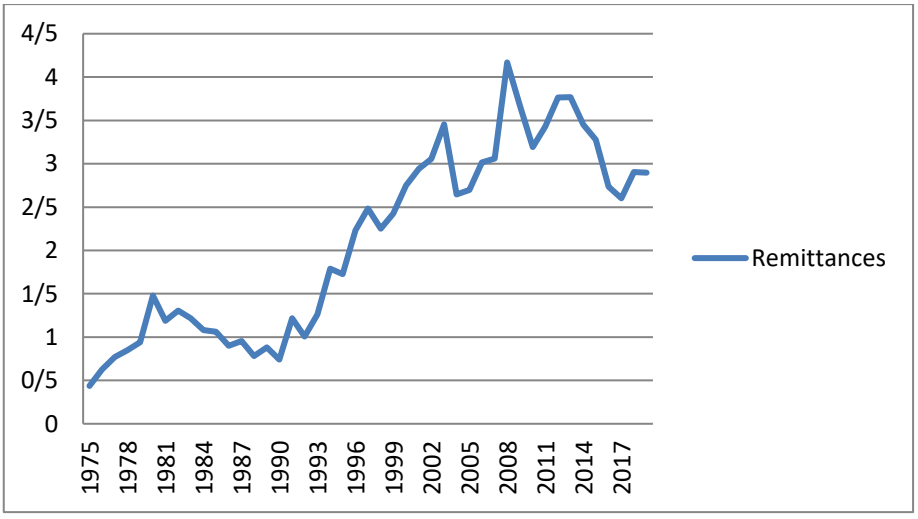


**Figure 2.** Remittances inflow as a percentage of GDP

**Source:** World Bank, 2021.

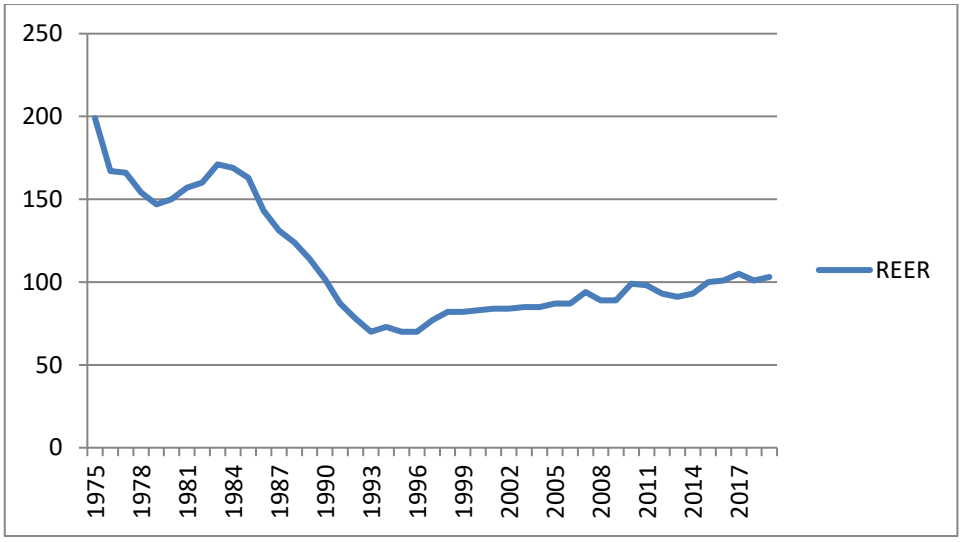


**Figure 3.** Trends of Real Effective Exchange Rate (2015=100)
**Source:** RBI, 2021.

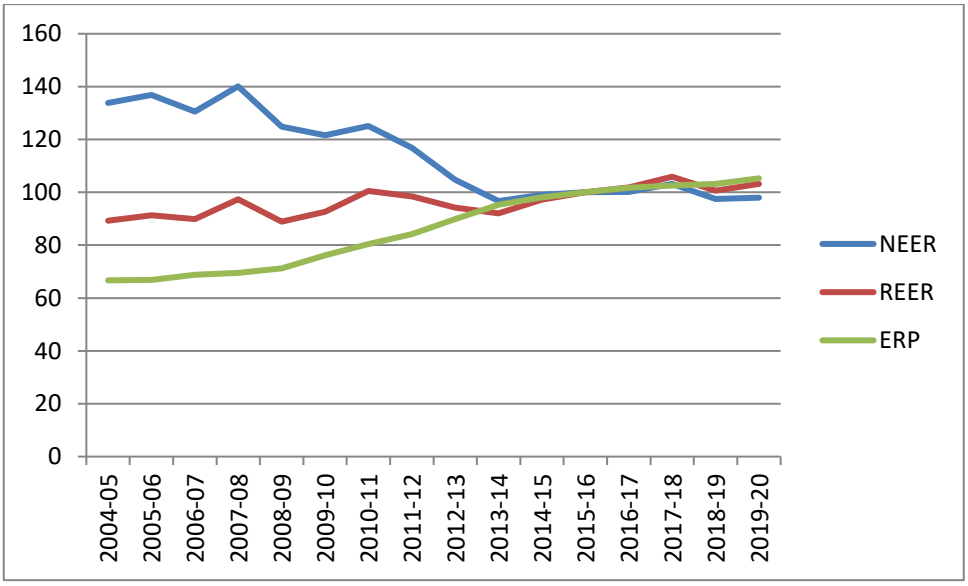


**Figure 4.** REER and Price Differentials (Base year: 2015=100)
**Source:** RBI Bulletin, 2021.

**5.2 Historical Trend of Output-Employment in Tradable and Non-Tradable Sector**

Figure 5 shows that the trend of the tradable sector as a share of GDP has a downward movement whereas there is an upward movement in the non-tradable sector as a share of the country's GDP. This implies that there is a contraction in the production in the tradable sector (agriculture and manufacturing sector) and an expansion in the non-tradable sector (service sector) during the period of analysis. Also, the share of

employment in the tradable sector has declined over the period even though the employment share in agriculture is larger than in the service sector. Whereas, the employment share in the non-tradable sector has increased significantly during the period of analysis. Figure 6 shows the share of employment in both sectors.

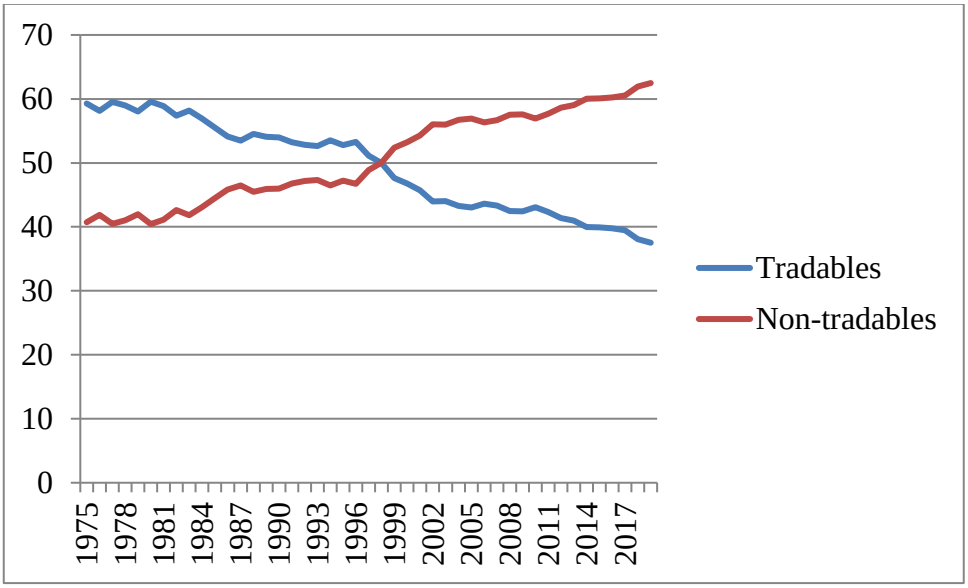


**Figure 5.** Percentage Share of Tradable and Non-Tradable
**Source:** World Bank, 2021.

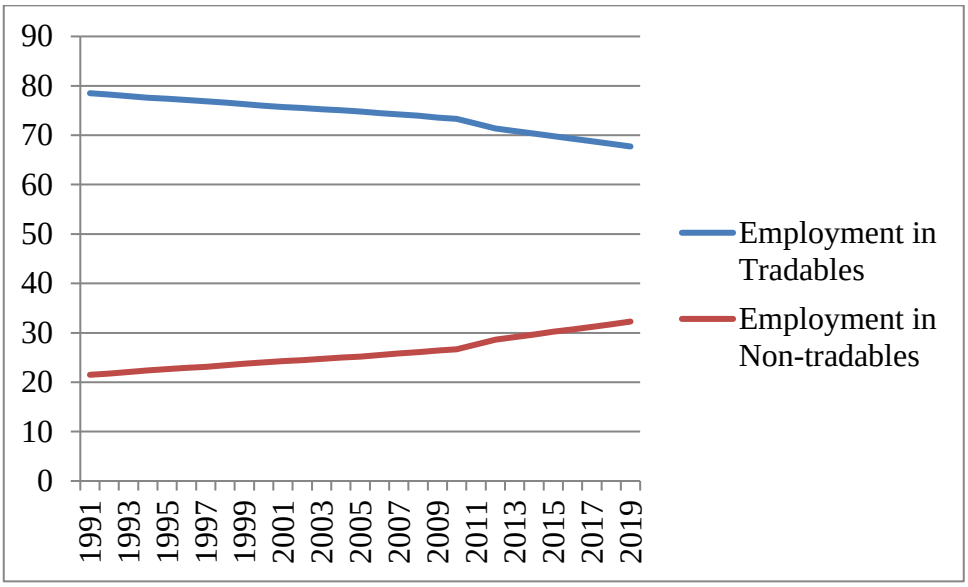


**Figure 6.** Percentage Change in Employment in Tradable and Non-tradable Sector
**Source:** World Bank, 2021.

## 6. Model Specification

In line with the theoretical framework of Dutch Disease, we run two regressions: one to examine *the spending effect* and other to examine *the resource movement effect*. To capture the spending effect we use the real effective exchange rate (REER) as a dependent variable in the spending effect regression equation. To capture the resource movement effect we use the traded to non-traded ratio as a dependent variable in the resource movement effect regression equation. In other words, through the resource movement effect equation, we check the relationship between remittances and traded and non-traded ratios. The two models are specified below:

*Spending Effect* model:

$$REER_t = \beta_0 + \beta_1 REM_t + \beta_2 TOT_t + \beta_3 GOVEXP_t + \beta_4 WIR_t + \beta_5 GR_t + \varepsilon_t \quad (1)$$

*Resource Movement Effect* model:

$$TNT_t = \beta_0 + \beta_1 REM_t + \beta_2 TOT_t + \beta_3 GOVEXP_t + \beta_4 WIR_t + \beta_5 GR_t + \mu_t \quad (2)$$

where, t= 1, 2…T.
REER = real effective exchange rate
TNT = ratio of traded and non- traded goods

REM = personal remittances (as % of GDP)
TOT = net barter terms of trade (as % of GDP)
GOVEXP = general government final consumption expenditure (as % of GDP)
WIR = the world's interest rate, where the interest rate on the US Treasury Bill is used as a proxy.
GR = real GDP per capita growth rate
$\varepsilon_t$ and $\mu_t$ are error terms

All the explanatory variables in equation (1) are chosen following literature on real exchange rates. The expected signs of the variables are discussed below:

From the theoretical literature, it is expected that remittances can have a positive impact on real exchange rate appreciation through the spending effect and resource movement effect. But if the inflows of remittances are used for capital accumulation the above expected result may not be the case in the long run.

The terms of trade may influence REER through income effect and substituting effect. Considering the income effect, if the price of export increases relative to the price of import, then there will be an increase in domestic income which will increase demand for both tradable and non- tradable goods. Since the price of tradable is determined exogenously it remains unchanged and the price of non-tradable increases relative to the price of tradable. This will cause appreciation of REER. Considering substituting effect, the increase in price of exports will reduce the foreign demand for export goods resulting in REER depreciation. So, the net impact of terms of trade on REER depends on which effect, substitution or income, dominates (Gantman and Dabos, 2018).

The influence of government expenditure on REER is ambiguous, if government expending falls disproportionally on non-tradable sector then there will be REER appreciation and vice-versa.

An increase in world interest rate can depreciate REER, as higher interest rates offer lenders a higher return relative to other countries and therefore there will be an outflow of foreign capital from the home country to high-interest rate foreign countries and will cause the exchange rate in the home country to depreciate.

We expect the impact of real per capita GDP growth on REER may be either positive or negative. If the supply effect of GDP growth is more than its demand effect then there will be a depreciation of REER. On the other hand, if the demand effect is more than the supply effect then there will be appreciation of REER.

In addition, the variables that are expected to have positive signs in Equation (1) are expected to have negative signs in Equation (2) and vice-versa. Because the variables

tend to appreciate, REER will also induce the movement of resources from tradable to non-tradable, and therefore the ratio of tradable to non-tradable will fall.

## 7. Data Description and Source of Data

Under this chapter, data for REER are taken from the Reserve Bank of India, 2021 and the data for all explanatory variables are obtained from the World Development Indicator, 2021 for the period 1980-2019. All the data used in this paper for analysis are annual data converted into logarithmic form except real GDP per capita growth and the world's interest rate. Details of the two dependent variables are given below and the details of other explanatory variables are discussed in the appendix.

*Real Effective Exchange Rate (REER):* The nominal effective exchange rate (NEER) and real effective exchange rate (REER) are indices used for measuring the external competitiveness of the country. The NEER is the weighted geometric mean of the bilateral nominal exchange rates of the home currency in terms of the currencies of major trading partners. Specifically,

$$NEER = \prod_{i=1}^{n} (\frac{e}{e_i})^{wi}$$

The REER is the NEER adjusted by the weighted average of the ratio of domestic prices to foreign prices. Specifically,

$$REER = \prod_{i=1}^{n} [\left(\frac{e}{e_i}\right)\left(\frac{p}{p_i}\right)]^{wi}$$

where,

e = Exchange rate of Indian rupee against a numeraire, i.e., the IMF's Special Drawing Rights (SDRs) in indexed form,

$e_i$ = Exchange rate of foreign currency 'i' against the numeraire (SDRs) (i.e., SDRs per currency i) in indexed form,

(a rise in 'e' or '$e/e_i$' represents an appreciation of the rupee relative to foreign currency 'i' and vice-versa).

$w_i$ = Weights attached to foreign currency/ country 'i' in the index

$\prod_{i=1}^{n} w_i = 1$

P = India's wholesale price index (WPI)

$P_i$ = Consumer Price Index of Country i ($CPI_i$), and

n = Number of countries/currencies in the index other than India. (RBI Bulletin, 2005).

The interpretation of NEER is that, if the index rises, other things being equal, the purchasing power of the currency also rises ( the currency strengthens against those of the country's trading partner). This will reduce import costs but will undermine export

competitiveness. If REER >100 then domestic goods are dearer than foreign goods or in other words, foreign goods are cheaper in comparison to domestic goods. If REER <100, domestic goods are cheaper than foreign goods. Here, P is taken as a proxy for the price of non-tradables, and $P_i$ is taken as a proxy for the price of tradables. So, when the relative price of non-tradables increases, other things remain the same, there is an appreciation of REER and this can reduce the external competitiveness of the country.

*Traded to Non-Traded Sector Ratio (TNT):* We have taken a sum of value added in the agriculture and manufacturing sector (as a share of GDP) as the proxy for the traded sector and value-added in the service sector (as a share of GDP) as the proxy for non-traded sector output. Agriculture (corresponding to ISIC divisions 1-5) includes forestry, hunting, and fishing, as well as the cultivation of crops and livestock production. Manufacturing refers to industries belonging to ISIC divisions 15-37. Service sector value added (corresponding to ISIC divisions 50-99) include value added in wholesale and retail trade (including hotels and restaurants), transport and government, financial, professional, and personal services such as education, health care, and real estate services (World Bank, 2021).

Table 1 reports the summary statistics of all the variables used in both the regression of the spending effect and the resource movement effect. The standard deviation of traded to non-traded ratio, remittances, real per capita GDP growth, and world interest rate has less dispersion from its respective mean than compared to other variables in the table below. That means, there exists less variability in the series of remittances, traded to non-traded ratio, real GDP per capita growth rate, and world interest rate. Also from the table below it can be seen that the Jarque-Bera test statistics of both REER and real GDP per capita growth are statistically significant at a 5% level, this implies that the series is not normally distributed. While the rest of the variables in the table below have a normal distribution.

**Table 1.** Summary Statistics

| | REER | TNT | REM | TOT | GOVEXP | GR | WIR |
|---|---|---|---|---|---|---|---|
| **Mean** | 110.2121 | 1.011885 | 2.112771 | 94.24406 | 10.72094 | 3.954348 | 4.423491 |
| **Median** | 97.90650 | 1.045660 | 2.249737 | 94.36652 | 10.68386 | 4.248844 | 4.637252 |
| **Max** | 198.6286 | 1.473348 | 4.168610 | 118.7500 | 12.17549 | 7.299421 | 13.94637 |
| **Min** | 69.85949 | 0.600559 | 0.436551 | 65.46763 | 9.209772 | -7.388104 | -0.051470 |
| **Std. Dev.** | 34.73062 | 0.286036 | 1.087759 | 12.17982 | 0.772418 | 2.703031 | 3.509336 |
| **Skewness** | 0.855761 | 0.164580 | 0.087773 | -0.153560 | 0.050958 | -1.748332 | 0.592306 |
| **Kurtosis** | 2.433293 | 1.592778 | 1.591142 | 2.913703 | 2.156494 | 8.067555 | 2.850754 |
| **Jarque-Bera** | 6.094617 | 3.916164 | 3.779435 | 0.169617 | 1.353543 | 71.07521 | 2.613560 |
| **Probability** | 0.047487 | 0.141129 | 0.151115 | 0.918688 | 0.508255 | 0.000000 | 0.270690 |
| **Obs.** | 45 | 45 | 45 | 40 | 45 | 45 | 44 |

**Source:** Research finding.

## 8. Estimation Methodology

In time series analysis, the variables used in the study must be stationary to avoid spurious regression. To check whether the series are stationary or not we used unit root test. Augmented Dickey-Fuller test (ADF) and Philips-Perron (PP) are used to check for the stationary properties of each series. For lag length selection of dependent and explanatory variables, we have used AIC and SIC criteria. As there was a major structural change in the economy post-1991 in the form of liberalization of the exchange rate, we employed the Quandt-Andrews Unknown Breakpoint test (Andrews, 1993; Andrews and Ploberger, 1994; Hansen, 1997) to check for the presence of a structural break in the dependent variable, REER. To analyze the long-run relationship among the variables understudy we employed the ARDL co-integration approach (2001). Further, to check for the stability of the long-run model and to analyze short-run dynamics we have used the Error Correction Model (ECM).

### 8.1 Co-integration Analysis (ARDL)

This approach starts with estimating bound tests to check if there exists a long-run relationship among the variables understudy. In a bound test, if the computed F-statistics exceeds the upper bound critical values (the critical values are provided by Pesaran et al., 2001), then the null hypothesis of no co-integration is rejected and there exists a long-run relationship between the variables. On the other hand, if the computed F- statistics falls below the lower bound critical value then the null hypothesis cannot be rejected and there is no long-run relationship between the variables. The outcome is inconclusive if the calculated value of F-statistics lies in between the two critical values.

For analyzing the long-run relationship among the variables with the ARDL approach, we rearrange Equations (1) and (2) in the following ARDL framework:

$$\begin{aligned}\Delta lnREER_t = {} & \beta_0 + \beta_1 lnREER_{t-1} + \beta_2 lnREM_{t-1} + \beta_3 lnTOT_{t-1} \\ & + \beta_4 lnGOVEXP_{t-1} + \beta_5 GR_{t-1} + \beta_6 WIR_{t-1} \\ & + \sum_{i=1}^{n} \beta_{7i} \Delta lnREER_{t-i} + \sum_{i=1}^{n} \beta_{8i} \Delta lnREM_{t-i} \\ & + \sum_{i=1}^{n} \beta_{9i} \Delta lnTOT_{t-i} + \sum_{i=1}^{n} \beta_{10i} \Delta lnGOVEXP_{t-i} \\ & + \sum_{i=1}^{n} \beta_{11i} \Delta GR_{t-i} + \sum_{i=1}^{n} \beta_{12i} \Delta WIR_{t-i} + \in_t \end{aligned} \quad (3)$$

$$\begin{aligned}\Delta lnTNT_t = {} & \beta_0 + \beta_1 lnTNT_{t-1} + \beta_2 lnREM_{t-1} + \beta_3 lnTOT_{t-1} \\ & + \beta_4 lnGOVEXP_{t-1} + \beta_5 GR_{t-1} + \beta_6 WIR_{t-1} \\ & + \sum_{i=1}^{n} \beta_{7i} \Delta lnTNT_{t-i} + \sum_{i=1}^{n} \beta_{8i} \Delta lnREM_{t-i} \\ & + \sum_{i=1}^{n} \beta_{9i} \Delta lnTOT_{t-i} + \sum_{i=1}^{n} \beta_{10i} \Delta lnGOVEXP_{t-i} \\ & + \sum_{i=1}^{n} \beta_{11i} \Delta GR_{t-i} + \sum_{i=1}^{n} \beta_{12i} \Delta WIR_{t-i} + \mu_t \end{aligned} \quad (4)$$

In Equations (3) and (4), the term with the first difference operator ($\Delta$) captures the short-run dynamics and the coefficients with one lagged term measure the long-run relationships of the variables.

If there is co-integration among the variables, we can estimate the Error Correction Model (ECM) to capture the short-run dynamics. The ECM model for Equations (1) and (2) is specified below:

$$\begin{aligned}\Delta lnREER_t = {} & \beta_0 + \sum_{i=1}^{n} \beta_{7i} \Delta lnREER_{t-i} + \sum_{i=1}^{n} \beta_{8i} \Delta lnREM_{t-i} \\ & + \sum_{i=1}^{n} \beta_{9i} \Delta lnTOT_{t-i} + \sum_{i=1}^{n} \beta_{10i} \Delta lnGOVEXP_{t-i} \\ & + \sum_{i=1}^{n} \beta_{11i} \Delta GR_{t-i} + \sum_{i=1}^{n} \beta_{12i} \Delta WIR_{t-i} + \gamma ECT_{t-1} \\ & + \in_t \end{aligned} \quad (5)$$

$$\Delta lnTNT_t = \beta_0 + \sum_{i=1}^{n} \beta_{7i} \Delta lnTNT_{t-i} + \sum_{i=1}^{n} \beta_{8i} \Delta lnREM_{t-i} + \sum_{i=1}^{n} \beta_{9i} \Delta lnTOT_{t-i} + \sum_{i=1}^{n} \beta_{10i} \Delta lnGOVEXP_{t-i} + \sum_{i=1}^{n} \beta_{11i} \Delta GR_{t-i} + \sum_{i=1}^{n} \beta_{12i} \Delta WIR_{t-i} + \gamma ECT_{t-1} + \mu_t \quad (6)$$

ECT denotes error correction term and it is derived from the long run estimated coefficients. Where, $ECT_t = lnREER_t - (\beta_0 + \beta_1 lnREER_{t-1} + \beta_2 lnREM_{t-1} + \beta_3 lnTOT_{t-1} + \beta_4 lnGOVEXP_{t-1} + \beta_5 GR_{t-1} + \beta_6 WIR_{t-1})$ for Equation (5) and $ECT_t = lnTNT_t - (\beta_0 + \beta_1 lnTNT_{t-1} + \beta_2 lnREM_{t-1} + \beta_3 lnTOT_{t-1} + \beta_4 lnGOVEXP_{t-1} + \beta_5 GR_{t-1} + \beta_6 WIR_{t-1})$ for Equation (6).

The coefficient of ECT tells us the speed of adjustment of the dependent variable to the long-run equilibrium following some exogenous shocks. If the coefficient of ECT is significant and negative, then there is a long-run relationship between the variables and the short-run model will converge to the long-run equilibrium.

## 9. Empirical Findings and Analysis

The study conducted ADF and PP unit root tests to check the order of integration of the variables understudy. Table 2 reported the ADF and PP unit root test results. The results show that all the variables are either integrated at order one or zero; therefore, the ARDL co-integration approach is best suited in this case.

**Table 2.** ADF and PP Unit Root Test

| Variables | Exogenous | ADF statistics | Prob* | PP statistics | Prob* | Decision |
|---|---|---|---|---|---|---|
| lnREER | Constant | -1.456976 | 0.5455 | -2.206158 | 0.2071 | I(1) |
| lnREER | Constant& trend | 0.911803 | 0.9453 | -1.325756 | 0.8683 | |
| D(lnREER) | Constant | -4.500655 | 0.0008 | -4.582449 | 0.0006 | |
| D(lnREER) | Constant& trend | -4.626425 | 0.0031 | -4.748597 | 0.0022 | |
| lnTNT | Constant | 0.128938 | 0.9645 | 0.131656 | 0.9647 | I(1) |
| lnTNT | Constant& Trend | -2.475166 | 0.3383 | -2.611311 | 0.2775 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| D(lnTNT) | Constant | -6.864153 | 0.0000 | -6.855827 | 0.0000 | |
| D(lnTNT) | Constant& Trend | -6.887201 | 0.0000 | -6.875547 | 0.0000 | |
| lnREM | Constant | -2.349805 | 0.1616 | -2.332630 | 0.1666 | I(1) |
| lnREM | Constant& trend | -2.315608 | 0.4171 | -2.559992 | 0.2996 | |
| D(lnREM) | Constant | -8.093103 | 0.0000 | -7.921269 | 0.0000 | |
| D(lnREM) | Constant& trend | -8.262913 | 0.0000 | -8.088067 | 0.0000 | |
| lnTOT | Constant | -2.630551 | 0.0956 | -2.474583 | 0.1293 | I(1) |
| lnTOT | Constant& trend | -2.509047 | 0.3223 | -2.329843 | 0.4088 | |
| D(lnTOT) | Constant | -5.504537 | 0.0001 | -6.716838 | 0.0000 | |
| D(lnTOT) | Constant& trend | -5.595078 | 0.0003 | -7.021906 | 0.0000 | |
| lnGOVEXP | Constant | -3.152750 | 0.0302 | -2.116484 | 0.2394 | I(0) |
| lnGOVEXP | Constant& trend | -3.207424 | 0.0968 | -2.315524 | 0.4171 | |
| D(lnGOVEXP) | Constant | -4.740801 | 0.0004 | -4.740801 | 0.0004 | |
| D(lnGOVEXP) | Constant& trend | -4.646246 | 0.0029 | -4.646246 | 0.0029 | |
| GR | Constant | -6.057663 | 0.0000 | -6.189577 | 0.0000 | I(0) |
| GR | Constant Trend | -8.107286 | 0.0000 | -11.98017 | 0.0000 | |
| WIR | Constant | -1.018961 | 0.7373 | -1.379332 | 0.5838 | I(1) |
| WIR | Constant& Trend | -4.990317 | 0.0011 | -2.524115 | 0.3157 | |
| D(WIR) | Constant | -4.962323 | 0.0002 | -4.200753 | 0.0019 | |
| D(WIR) | Constant& Trend | 4.247165 | 0.0088 | -4.143275 | 0.0112 | |

**Source:** Research finding.

**Note:** *MacKinnon (1996) one-sided p-values.

The study also conducted the Quandt-Andrews Unknown Breakpoint test to discover any structural break in the data set where REER is taken as a dependent variable. The result of the test is reported in Table 3. The Maximum LR F- Statistics and Maximum Wald F-Statistics identified 1991 as a structural breakpoint which is also statistically significant. Therefore, the null hypothesis of no breakpoint is rejected at a 1 percent level.

**Table 3.** Results of Quandt-Andrews Breakpoint Test

| Statistics | Break-point date | Value | Prob. |
|---|---|---|---|
| Maximum LR F-Statistics | 1991 | 18.94857* | 0.0000 |
| Maximum Wald F-Statistics | 1991 | 94.74287* | 0.0000 |

**Source:** Research finding.

**Note:** * denotes the level of significance at 1 percent.

### 9.1 Estimation of the Spending Effect Model

To check if there exists a long-run relationship between the variables present in the spending effect model we applied the F-bounds test reported in Table 4. The F-statistics of 15.19 is greater than the upper bound critical value of 4.68 and is also statistically significant at a 1 percent level. Therefore, the null hypothesis of no co-integration is rejected and there exist long-run relationship between the variables when REER is taken as dependent variable.

**Table 4.** Results of ARDL Bound Test

| F-statistic | Significance Level | Critical I (1) | Critical I (0) |
|---|---|---|---|
| 15.19195 | 1% | 4.68 | 3.41 |
| | 2.5% | 4.18 | 2.96 |
| | 5% | 3.79 | 2.62 |
| | 10% | 3.35 | 2.26 |

**Source:** Research finding.

Since there exists long run relationship between the variables in spending effect equation, we proceed for its long run estimation. The long run estimated coefficients of REER, REM and other explanatory variables are reported in Table 5. The result shows that remittances have a positive effect on the real effective exchange rate (REER) in India. That is, a one percent increase in remittances leads to a 0.52 percent increase in the real effective exchange rate in India. The coefficient of remittance (REM) is statistically significant at a one percent level. So, we can say that an increased inflow of remittances causes a real effective exchange rate to appreciate. The net barter terms of trade have statistically significant and positive effects on real effective exchange rates. The increase in the price of exports relative to the price of imports raises the real effective exchange rate in India. That means an increase in net barter terms of trade has an income effect that appreciates the real effective exchange rate of the country. Government expenditure has a depreciating effect on the real effective exchange rate in India. That means government expenses are directed toward increasing the productivity level of both tradable and non-tradable goods. Real GDP per capita growth also has a negative impact on REER. This implies an increase in

GDP growth rate of India helps in increasing the productivity of both tradables and non-tradables. It is also seen that the world's interest rate (WIR) does not have any depreciating effect on REER in the country. The coefficients of REM, TOT, GOVEXP, GR, and WIR are 0.52, 1.13, -2.56, -0.06, and 0.07 respectively.

**Table 5.** Estimated Long Run Coefficients (Dependent Variable: lnREER)

| Variables | Coefficient | t-Statistic | p-value |
|---|---|---|---|
| lnREM | 0.527738* | 2.951374 | 0.0085 |
| lnTOT | 1.139933** | 2.679712 | 0.0153 |
| lnGOVEXP | -2.565337* | -4.691580 | 0.0002 |
| GR | -0.060264* | -3.147854 | 0.0056 |
| WIR | 0.074416** | 2.828423 | 0.0111 |

**Source:** Research finding.

**Note:** * and** represents significance level at 1 percent and 5 percent respectively.

To analyze the short-run dynamics and to confirm the reliability of the long-run estimated coefficients we employed the Error Correction Model (ECM). The result of the Error Correction Model is reported in Table 6. The $ECT_{t-1}$ is negative (-0.36) and statistically significant at one percent level. This implies there is convergence towards long-run equilibrium with an adjustment speed of 36 percent per year. In other words, any disequilibrium in the current period following an exogenous shock will be corrected by 36 percent in the following year. Thus there is a moderate speed of adjustment towards an equilibrium level.

The model shows that REM does not have any statistically significant impact on REER in the short run. The rest of the variables are statistically significant and have the same sign as in the long run. The coefficients of TOT, GOVEXP, GR, and WIR are 1.07, -0.588, -0.005, and 0.017 respectively.

**Table 6.** Error Correction Model [Dependent Variable: D(lnREER)]

| Explanatory Variable | Coefficient | t-Statistic | p-value |
|---|---|---|---|
| D(lnREM) | 0.033 | 0.907 | 0.3759 |
| D(lnTOT) | 0.107*** | 1.889 | 0.0750 |
| D(lnGOVEXP) | -0.588* | -4.438 | 0.0003 |
| D(GR) | -0.005*** | -1.948 | 0.0671 |
| D(WIR) | 0.017* | 4.360 | 0.0004 |
| $ECT_{t-1}$ | -0.363* | -10.792 | 0.0000 |
| Adjusted R-Squared | 0.876193 | DW-Statistics | 2.131022 |

**Source:** Research finding.

**Note:** *, ** and *** represent a significance level at 1 percent, 5 percent, and 10 percent.

We have conducted a diagnostic test to further examine the reliability of the selected ARDL model. The results of the diagnostic test are reported in Table7. The test shows that the estimated model is free from serial correlation, heteroskedasticity, and non-normality. The Ramsey RESET test also suggests that the estimated model is free from specification error.

Further, to check the stability of the estimated model we employed cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ) tests. Figures 6 and 7 show that the estimated lines are within critical values of 5 percent level. Therefore, the model estimated is reliable and stable.

**Table 7.** Diagnostic Test

| **Serial correlation LM test: Breusch-Godfrey Serial Correlation LM test** | |
|---|---|
| F-statistics: | 2.502033(0.1134) |
| **Heteroskedasticity test:** | |
| ARCH | F-statistics: 0.483109(0.4915) |
| Breusch-Pagan-Godfrey | F-statistics: 0.781779(0.7045) |
| **Normality test:** | |
| Jarque bera | 0.388857(0.823305) |
| **Ramsey RESET test** | F-statistics: 0.777785(0.4428) |

**Source:** Research finding.

**Note:** Numbers in parenthesis denote p-values.

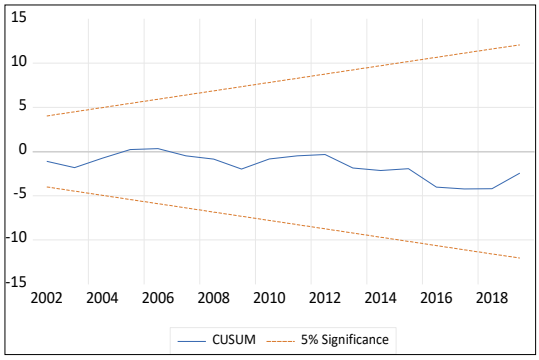


**Figure 6.** CUSUM Test
**Source:** Research finding.

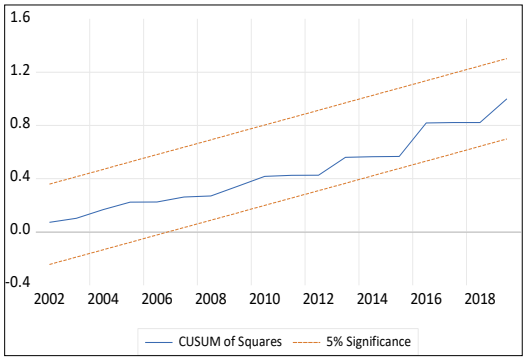


**Figure 7.** CUSUMSQ Test
**Source:** Research finding.

### 9.2 Estimation of Resource Movement Effect Model

Again, for estimating the resource movement effect model, we do the same procedure of first checking the existence of a long-run relationship between TNT, REM, and other variables present in the model through bound test. The result of the bound test is reported in Table 8. The result shows that the F-statistic (11.833) exceeds the upper bound critical value (4.68) at a 1 percent level. Therefore, the null hypothesis of no levels relationship is rejected or so to say there exists a long-run relationship between the variables.

**Table 8.** Result of ARDL Bound Test

| F-Statistic | Significance Level | Critical I (1) | Critical I (0) |
|---|---|---|---|
| 11.83341 | 1% | 4.68 | 3.41 |
| | 2.5% | 4.18 | 2.96 |
| | 5% | 3.79 | 2.62 |
| | 10% | 3.35 | 2.26 |

**Source:** Research finding.

The presence of co-integration among the variables enables us to estimate the long-run model. The result of the long-run estimated model is reported in Table 9. Remittances as a percentage of GDP have a negative expected sign and are statistically significant at a 1 percent level. That means an inflow of remittances in the country has a dampening effect on the tradable sector while the non-tradable sector expands. A one percent increase in remittances inflow leads to a 0.53 percent fall in the TNT ratio. This proves the resource movement effect in the country due to the inflow of remittances. The net barter terms of trade (TOT) have a negative association with traded to non-traded ratio (TNT) but the coefficient is not statistically significant. Government expenditure has a negative effect on TNT by 0.92 percent. Although government expenditure does not appreciate REER, it tends to reduce the TNT ratio.

Note that we have taken general government final consumption expenditure as a proxy for government expenditure, which consists of expenditures mainly on education, health, housing, defense, etc., this might be the reason for the relative expansion of the non-tradable sector with government expenditure. Real GDP per capita growth (GR) has a positive effect of 0.165 percent on the TNT ratio. Since we have a negative association between GR and REER, it was expected to have a positive association between GR and TNT. This finding implies that the growth in real GDP per capita in India aids in increasing the export competitiveness of the country and expanding the traded manufacturing sector. In addition, a one percent increase in the world's interest rate (WIR) leads to a 0.03 percent increase in the TNT ratio.

**Table 9.** Estimated Long run Coefficients (Dependent Variable: lnTNT)

| Variable | Coefficient | t-Statistics | p-value |
|---|---|---|---|
| lnREM | -0.563* | -4.709015 | 0.0005 |
| lnTOT | -0.479 | -1.663438 | 0.1221 |
| lnGOVEXP | -0.920** | -2.187790 | 0.0492 |
| GR | 0.165* | 3.208604 | 0.0075 |
| WIR | 0.034** | 2.449278 | 0.0306 |

**Source:** Research finding.

**Note:** * and** represent significance levels at 1 percent and 5 percent respectively.

In the error correction model reported in Table 10, the ECT is negative and statistically significant at a one percent level. This indicates that the above long-run model is stable and there exist long run relationship between the variables. The speed of adjustment towards long-run equilibrium is 27 percent per year. The finding also reveals that remittances do not have any short-run impact on the TNT ratio. The estimated short-run coefficients of TOT, GOVEXP, and GR are 0.176, -0.485, and 0.013 percent respectively. The coefficient of WIR is statistically insignificant in the short run.

**Table 10.** Estimated Error Correction Model [Dependent Variable: D(lnTNT)]

| Variable | Coefficient | t-Statistics | p-value |
|---|---|---|---|
| D(lnREM) | 0.0337 | 1.736669 | 0.1080 |
| D(lnTOT) | 0.176* | 3.618913 | 0.0035 |
| D(lnGOVEXP) | -0.485* | -5.935648 | 0.0001 |
| D(GR) | 0.013* | 7.258934 | 0.0000 |
| D(WIR) | 0.003 | 1.158760 | 0.2691 |
| $ECT_{t-1}$ | -0.274* | -10.02916 | 0.0000 |
| Adjusted R-Squared | 0.854694 | DW-Statistics | 2.308826 |

**Source:** Research finding.

**Note:** * represents significance level at 1 percent level.

The diagnostic test for the ARDL model on resource movement effect is reported in Table 11. The test reveals that the model is free from serial correlation, heteroscedasticity, and non-normality in the distribution. Further, the Ramsey RESET test suggests that the model is free from specification error. Figures 8 and 9 show the CUSUM and CUSUMSQ graph respectively in which the estimated lines are within the critical values of a 5 percent level. Therefore, the estimated ARDL model is reliable and stable.

**Table 11.** Diagnostic Test

| **Serial correlation LM test: Breusch-Godfrey Serial Correlation LM test** | |
|---|---|
| F-statistics: | 0.883922(0.4431) |
| **Heteroskedasticity test:** | |
| ARCH | F-statistics: 0.563771(0.4578) |
| Breusch-Pagan-Godfrey | F-statistics: 1.512693(0.2293) |
| **Normality test:** | |
| Jarque bera | 1.070193(0.585613) |
| **Ramsey RESET test** | F-statistics: 1.053410(0.3268) |

**Source:** Research finding.
**Note:** Numbers in parenthesis denotes p-values.

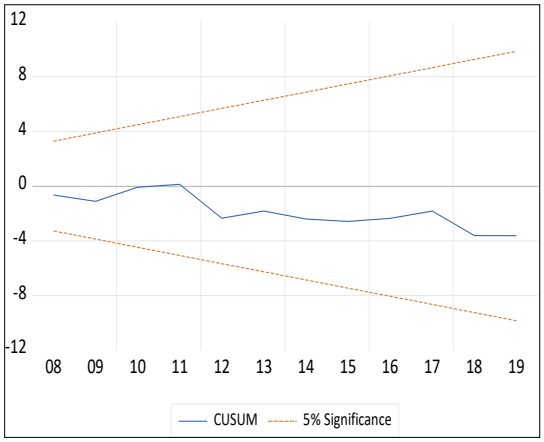


**Figure 8.** CUSUM Test
**Source:** Research finding.

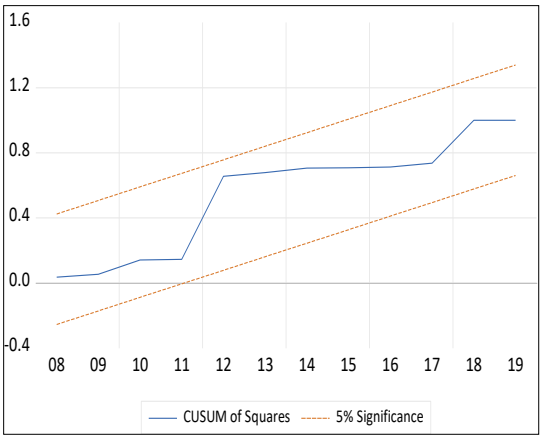


**Figure 9.** CUSUMSQ Test
**Source:** Research finding.

## 10. Conclusion

The objective of this paper was to find out if there is a Dutch Disease effect of remittance inflow in India. For this, we have employed two separate regressions to examine the spending effect as well as the resource movement effect. The spending effect examines real effective exchange rate appreciation whereas the resource movement effect examines a fall in traded to non-traded ratio. To study these effects we have used the ARDL approach with data for the period of 1975-2019. Based on this approach, we found that there is a presence of the Dutch Disease effect of remittances inflow in the country. A one percent increase in remittances leads to a 0.52 percent increase in REER. And, a one percent increase in remittances leads to a 0.56 percent fall in the tradable to non-tradable ratio. Both these coefficients are substantial in magnitude and statistically significant at a one percent level. The findings indicate that with an increased inflow of remittances, there is a loss of international competitiveness and contraction of the tradable manufacturing sector in the country. This is evident from the historical facts of India that over the period service sector in India expanded while there was a contraction of the manufacturing sector. Value added in the manufacturing sector as percent of GDP was 15.83 percent in 1975 which has fallen to 13.64 percent in 2019. Value added in the service sector (as a percent of GDP) was 35.13 in 1975 and has risen to 49.38 in 2019. Since more than 50 percent of inward remittances in India are spent on consumption (RBI, 2018), the demand for non-tradable goods rises and fuels inflation in the country. This appreciates the real exchange rate of the country. If the maximum amount of these inflows is spent on productive activities and capital formation, this could result in the growth of both tradable and non-tradable sectors without the creation of any inflationary pressure in the country.

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## Appendix

**- Personal Remittances, Received (% of GDP)**

Personal remittances comprise personal transfers and compensation of employees. Personal transfers consist of all current transfers in cash or in kind made or received by resident households to or from nonresident households. Personal transfers thus include all current transfers between resident and nonresident individuals. Compensation of employees refers to the income of border, seasonal, and other short-term workers who are employed in an economy where they are not resident and of residents employed by nonresident entities. Data are the sum of two items defined in the sixth edition of the IMF's Balance of Payments Manual: personal transfers and compensation of employees.

**- Net Barter Terms of Trade Index (2000=100)**

Net barter terms of trade index are calculated as the percentage ratio of the export unit value indexes to the import unit value indexes, measured relative to the base year 2000.

**- General Government Final Consumption Expenditure (% of GDP)**

It includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditures on national

defense and security but excludes government military expenditures that are part of government capital formation.

**- Real Gross Domestic Product Per capita Growth**

Real gross domestic product per capita growth is the annual percentage growth rate of GDP per capita based on constant local currency. Aggregates are based on constant 2010 U.S. dollars. GDP per capita is gross domestic product divided by midyear population. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for the depreciation of fabricated assets or for the depletion and degradation of natural resources.

**- World's Interest Rate**

The interest rate on the US Treasury bill is taken as a proxy for measuring the world's interest rate.



**Cite this article:** Das, M., & Chakraborty, D. K. (2024). Does Remittances Inflow in India Have Dutch Disease Effects? ARDL Cointegration Approach. *Iranian Economic Review*, *28*(1), 49-77.