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Remittances in the Monetary Policy Transmission Mechanism: Evidence from India

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Abstract
Remittances have become a vital component of India's economy, with the country consistently ranking among the top recipients of international remittances. This influx of foreign exchange earnings has significant implications for India's macroeconomic dynamics, influencing economic growth, poverty reduction, and household well-being. This study explores the trends, patterns, and impact of remittances in India, highlighting the country's unique characteristics and regional variations. This study examines the dynamic relationship between remittances and GDP growth using a Generalized Additive Model (GAM) framework combined with Impulse Response Function (IRF) analysis. By modeling the non-linear effects of remittances on economic growth, this research provides new insights into the complex interactions between these variables. To assess the impact further ARDL model has been used after making certain additions to it.

Keywords: Remittances, GDP growth, Generalized Additive Model, Impulse Response Function, ARDL

Introduction

Remittances are funds that expatriates or migrant workers send back to their home countries, typically to family members or friends. These transfers play a vital role in the economies of many developing countries, serving as a stable source of foreign exchange earnings and contributing significantly to the GDP. It can boost economic growth, reduce poverty, and improve living standards in recipient countries apart from providing a safety net for families during economic downturns or natural disasters. Further remittances can be used for investments in education, healthcare, and entrepreneurship, contributing to long-term development.

Remittances have transformed into a major force in the global economy, providing crucial financial support to millions of households. It has become a vital component of international finance, significantly influencing the economies of countries that receive them. The rapid expansion of the global remittance market has provided essential financial support to numerous households worldwide. Remittances have undergone significant growth since the 1970s, transforming from a minor contributor to a major force in the global economy. This expansion can be attributed to several key factors. Globalization has opened up new economic opportunities abroad, allowing individuals to seek better livelihoods and send money back

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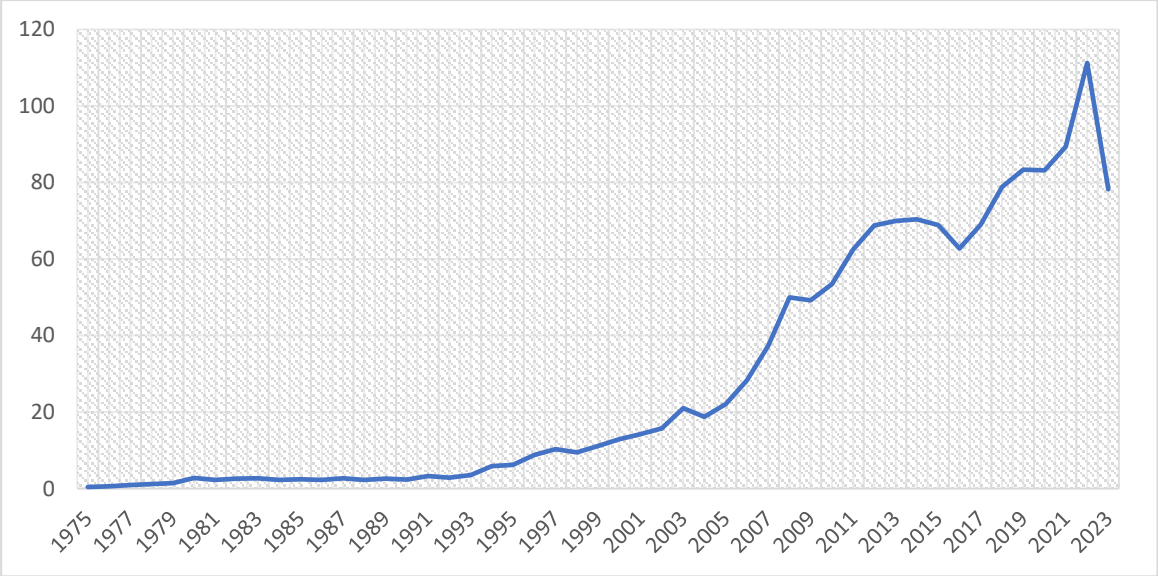
home. Additionally, economic growth in recipient countries has created a favorable environment for remittances to flow. Furthermore, advancements in financial technology, such as digital payment systems and mobile money services, have reduced transaction costs and made it easier for migrants to send remittances, ultimately contributing to their growing importance in the global economy.

Graph 1: Remittances (in Rupees Billions)



Source: Based on Data obtained from World Bank Database

The steady growth of remittances in India since the 1970s has been a remarkable phenomenon, catapulting them from a relatively minor economic factor to a major driver of global financial flows. This upward trend can be attributed to the increasing interconnectedness of the world economy, which has facilitated the movement of people across borders in search of better opportunities. As recipient countries have experienced economic growth, they have created a conducive environment for remittances to flourish. Moreover, innovations in financial technology, such as digital payment platforms and mobile money services, have streamlined the process of sending and receiving remittances, reducing costs and increasing efficiency.

Furthermore, remittances have proven to be a more stable source of external financing compared to foreign direct investment and official development assistance, which can be volatile and subject to fluctuations in global economic conditions. As the global economy continues to evolve, remittances are likely to remain an important factor in shaping the economic landscape of developing countries. The increasing adoption of digital technologies and innovative financial solutions is expected to further reduce transaction costs and increase the efficiency of remittance flows.

The economic landscape is variedly vast and dynamic, which alters the impact of remittances every time it penetrates a layer deeper. Role of remittances in the Monetary Policy Transmission Mechanism is multifaceted and context-dependent. Remittances can influence the effectiveness of monetary policy by altering the transmission channels, such as interest rates, credit, and exchange rates. In economies with significant remittance inflows, it must be considered that what potential impact of these flows on monetary policy transmission can be, as they can increase household consumption and investment, potentially reducing the effectiveness of monetary policy. It can also appreciate the exchange rate, affecting trade

competitiveness and inflation. Furthermore, remittances can also impact the financial sector's stability and liquidity, potentially altering the transmission of monetary policy decisions.

The complex interplay between remittances and monetary policy transmission can have far-reaching implications for economic growth, inflation, and financial stability. As remittance flows continue to evolve and grow, their impact on the transmission mechanism is likely to become increasingly significant, underscoring the need for a nuanced understanding of these dynamics.

Review Of Literature

India has been the largest recipient of remittances, exceeding other forms of financial inflows and significantly influencing the country's macroeconomic landscape (World Bank, 2022). Nevertheless, researches suggests that India's dependence on remittances is nuanced (Tumbe, 2011) that despite the fact India received the highest amount of remittances it is don't dependent on it. The World Bank (2015) also notes that India's reliance on remittances differs from countries like Nepal, Bangladesh, and the Philippines as they have been found to be more dependent on remittances. Further for the remittances to enhance growth is subject many other factors one of it being the uses that remittances are being put to. Studies utilizing National Sample Survey Organization (NSSO) data reveal that households receiving remittances tend to allocate less to food consumption and more to investments (Mahapatro et al., 2017). The economic impact of remittances in India is shaped by how they are utilized (NSSO, 2010). According to the Reserve Bank of India (RBI, 2010), remittances are primarily used for family maintenance, savings, and investments. The stability of remittances makes them a valuable tool for economic growth and development (Singh and Hari, 2011). Remittances have been found to positively impact households, particularly in rural areas, by reducing poverty incidence (Dey, 2015) and improving overall well-being (Mohanty et al., 2016). In Kerala, remittances have been shown to increase household per capita income and alter spending patterns, with recipients more likely to invest in non-food durable goods (Sunny et al., 2020). Notably, the majority of remittances to India originate from GCC nations, with Kerala receiving a disproportionate share despite sending fewer migrants compared to states like Uttar Pradesh and Bihar (Mitra and Kasliwal, 2020; Ghosh, 2020).

As proved by Stahl and Arnold (1986) in their study focusing on Asian countries, the developmental impact of remittances is derived by the multiplier effect of consumption. Similarly, Ratha (2007) found that there is a multiplier effect of remittances as with this there will be increase in consumption level of rural household since they are likely to be spent on domestic purpose. But varied results have been witnessed, Giuliano and Ruiz-Arranz (2005) found that remittances would lead to economic growth only in case of financially less-developing countries.

It is already known that the inflow of remittances has an altering impact on a number of macroeconomic variables. But once remittances enter any country, there are layers and layers of mechanisms that it has to go through, monetary policy being one of it. Ruiz and Silva (2010) conducted a study over Mexico stating that it is the second largest recipient of remittances in the world. So, they concluded that remittances shocks do not have large impact on the Mexico's monetary policy as the only concern of their central bank is inflation and appreciating of the currency. Chami et al., (2006) concluded in their study that the government should consider and examine a range of policy instruments when dealing with private capital flows as well as private income transfers such as remittances. Adenutsi and Aortor (2008) found in case of Ghana that monetary aggregates, exchange rates, and interest rates positively impact remittance inflows. Whereas domestic price levels negatively impact remittance inflows. While remittances in turn, can

influence monetary aggregates, exchange rates, interest rates, and domestic price levels. Vacaflores (2012) further highlights the complex impact of remittances on small open economies, apart from contributing to the GDP of the country it increases the liquidity effects in response to monetary shocks. Moreover, positive remittances shocks improve consumption and lowers the interest rates but reduce the work force as well which lowers the output in the economy. Mbutor (2010) conducted a study in case of Nigeria and concluded that economic growth in the country has encouraged the inflow of remittances into the country while exchange rate depreciation discourages remittances inflow which represented the remitters perception that a stronger Naira means strengthening of the home country. He further discussed the underlying phenomenon the monetary policy would impact the intervening variables like exchange rate, interest rate, inflation first which would further impact the remittances inflow. Termos et al., (2016) also included remittances in the money-demand equation considering the GCC and USA and found that the influence of the Federal Funds rate on money demand in GCC countries weakened during the 2002-2009 oil boom. In contrast, economic recessions in the US did not have a statistically significant impact on money demand in these countries. Barajas et al., (2018) found that remittances weaken the bank lending channels and monetary transmission. The reason they provided was that remittances are a stable and interest-insensitive source of funds for the banks but these fundings may not necessarily translate into more credit. This way interbank market fails because the funds rests with the banks which delinks bank's marginal cost of funds from movements in policy rates. Singer (2010) conducted a study considering 74 developing countries and found that emittances increase the likelihood of adopting fixed exchange rates, further arguing that remittances are stable and countercyclical, reducing the costs of forgone monetary policy autonomy it serves as an international risk-sharing mechanism.

Objective of the study

The paper is broadly divided into two sections, in the first part aims to analyse the relationship among given variables whether it is linear, curvilinear or non-linear. And in the second part, paper explores the impact to compliment the findings obtained in the previous section and obtain a meaningful relation thereby.

Data and Methodology

This study has extracted data from the World Bank database, covering the period from 1975 to 2023. To validate the findings, the analysis employs Generalized Additive Models, complemented by Impulse Response Function. The methodology involves several steps. Initially, the stationarity of the variables is assessed using the Augmented Dicky-Fuller.

The Generalized Additive Model is a kind of statistical model that extends the traditional Generalized Linear Model (GLM) framework. It effectively captures the non-linear relationships between predictor variables and the response variable. It also assumes an additive relationship between the predictor variables, allowing for interpretation of individual effects.

$g(\mu) = a+f_1(x_1) +\ldots+ f_p(x_p)$

where;

- a is the intercept,
- g() is the link function
- μ is the expected value of the response variable
- p is the number of predictor variables

- $f_p(x_p)$ are smooth functions of the predictor variables x_p

GDPgrowth = β_0 + s1(log Remittances) + s2(Population Growth) + s3(Inflation) + s4(Real Interest Rate) + s5(Terms Of Trade) + s6(Exchange Rate) + ε

where:

- β_0 is the intercept
- s1(), s2(), ..., s6() are smooth functions of the predictor variables
- ε is the error term

Further after determining the linearity of the relationship, the impact has been analysed using ARDL bound testing approach. This has been done to accommodate the findings of GAM further as it will give coefficients. But the model has been modified a bit as after determining the linearity of the relationship and interactive term of Real Interest Rate and Remittances has been added to highlight the underlying influence of Remittances on the monetary policy transmission mechanism.

GDPgrowth = β_0 + β_1.logRemit + β_2.RealInterestRate + β_3.PopulationGrowth + β_4.InflationCPI + β_5.TermsOfTrade + β_6.ExchangeRate + β_7.Intt*Remit + ε

Everything in the model is as it is except for individual beta coefficients for every variable and an additional variable which is basically an interactive value obtained by multiplying Remittances with the Real Interest Rate represented as "Intt*Remit".

Results and Discussion

The analysis begins with stationarity tests, Augmented Dicky-Fuller test has been used to assess the order of integration among variables. Mixed order integration has been found among the variables. This study focuses more on understanding the direction, flow and intensity of the changes that may follow rather than predicting the actual impact and its magnitude. Given the scope and subject of the study, Generalized Additive Model has been used to capture the nonlinear relationship. As GAM can capture short-run dynamics between I(0) variables and differenced I(1) variables.

Table 1: Stationarity Results of Augmented Dicky-Fuller test

	At Level			
Variables	**1pct**	**5pct**	**10pct**	**test-statistic**
GDP growth	-4.15	-3.5	-3.18	-5.5042***
Log Remit	-4.15	-3.5	-3.18	-1.5114
Population Growth	-4.15	-3.5	-3.18	-2.8191
Inflation	-4.15	-3.5	-3.18	-4.5727***
Real Interest Rate	-4.15	-3.5	-3.18	-3.6091**
Terms Of Trade	-4.15	-3.5	-3.18	-1.79
Exchange Rate	-4.15	-3.5	-3.18	-1.9698
InttRate*Remittances	-4.15	-3.5	-3.18	-3.5396**
	At First Difference			
GDP growth	-	-	-	-
Log Remit	-2.62	-1.95	-1.61	-3.3145***

Population Growth	-2.62	-1.95	-1.61	-3.8656***
Inflation	-	-	-	-
Real Interest Rate	-	-	-	-
Terms Of Trade	-2.62	-1.95	-1.61	-3.897***
Exchange Rate	-2.62	-1.95	-1.61	-2.447**
InttRate*Remittances	-2.62	-1.95	-1.61	-6.4164***

Source: Author's own calculation

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' '

As can be seen that both, trace statistics and eigen statistics confirm that there are at least 3 cointegrating vectors, so there is evidence of multiple long-run relationships between the variables. The cointegration analysis provides evidence of long-run relationships, which can be modelled using GAMs. This ensures the GAM model captures long-run relationship.

Further based on the EDF values the extent and strength of the trend can be determined. EDF or the Estimated Degrees of Freedom is a measure used in Generalized Additive Models to describe the complexity of a smooth function

Table 2: EDF-Based Nonlinearity Classification

EDF Values	**Relationship Types**
EDF > 1	Non-linear Relationship
EDF = 1	Linear Relationship
EDF > 5	Highly Non-linear Relationship

Source: Author's own creation

This is basically a 'Gaussian' model which assumes that the response variable follows a normal distribution, implying that the residuals are normally distributed. This specification is suitable for continuous data and allows for modeling relationships between variables using smooth functions. It also enables the use of standard statistical inference techniques, such as hypothesis testing and confidence intervals, to draw conclusions about the relationships modeled in the data. The results obtained were after 25 iterations indicating that the algorithm took 25 iterations to converge. And the Root Mean Square (RMS) gradient of the Generalized Cross-Validation (GCV) score at convergence was very small (4.30078e-07), indicating that the optimization process has reached a stable point. Further the Hessian matrix is positive definite, which confirms that the converged solution is a minimum, indicating a stable and reliable estimate of the smoothing parameters. So, the results (Table 5) are very well capturing the 'Relationship Type'. Afterwards there is Table 4 that can be used the validate the results obtained in Table 6. The basis dimension checking results warn that a low p-value, combined with a k-index less than 1, may indicate that the chosen k is too low. This is particularly concerning if the Estimated Degrees of Freedom (EDF) is close to the basis dimension (k'). When k is too low, the model may fail to capture complex relationships or nonlinear patterns in the data, leading to over smoothing and potentially biased estimates. To address this, it's essential to check the k-index and p-value, and consider increasing k if necessary, allowing the model to accurately represent the underlying relationships in the data.

Table 3: EDF and P-Value Summary

	edf	Ref.df	F	p-value
s(logRemit)	3	3	4.434	0.01246 *
s(PopulationGrowth)	4.763	5.743	2.216	0.06246 .
s(Inflation)	5.654	6.488	4.178	0.00449 **
s(RealInterestRate)	3.919	4.749	4.566	0.00707 **
s(TermsOfTrade)	4.554	5.586	4.155	0.00839 **
s(ExchangeRate)	1	1	0.004	0.95067

Source: Author's own calculation

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 4: Basis dimension (k) checking results.

	k'	edf	k-index	p-value
s(logRemit)	3	3	1.09	0.69
s(PopulationGrowth)	9	4.763	1.08	0.6
s(Inflation)	9	5.654	1.14	0.78
s(RealInterestRate)	9	3.919	1.16	0.81
s(TermsOfTrade)	9	4.554	0.99	0.38
s(ExchangeRate)	9	1	0.96	0.4

Sources: Author's own calculation

Table 5: Intercept of GAM

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	5.731	0.2767	20.71	<2e-16 ***

Source: Author's own calculation

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

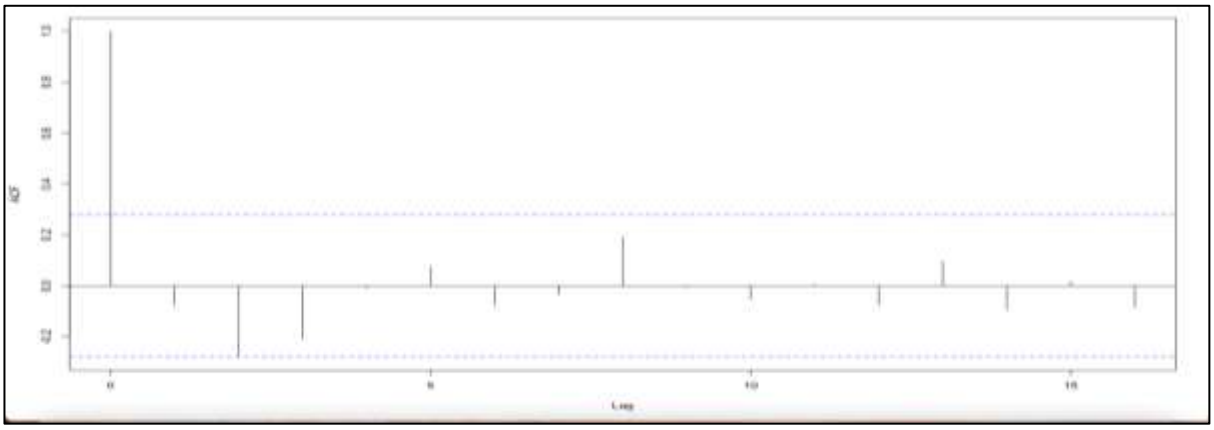
The EDF value for Remittances is coming out to be 3, indicating a Non-Linear relationship of Remittances with GDP growth. This involves threshold effects, diminishing returns, and other complex patterns while understanding the flow and trend of remittances in India. The nonlinear relationship indicates that the effect of Remittances on GDP growth is not constant and may vary depending on the level of Remittances. As is already discussed before that GAM tries to capture the Non-Linear patterns in the relationship, while models for linear regression tries to assess the impact assuming linearity. Most of the studies using linear regression models have found positive impact of remittances on the Gross Domestic Product, but when remittances are equated against GDP growth may not always conclude positive outcomes always. Reason being that remittances impacts the economy through direct and indirect mechanisms. As can be seen in the Graph 5, remittances is following slightly constant trend upto the threshold limit 10.0 and afterwards it starts to decline to the extent of going negative even. This would mean that the remittances would lead to growth in the GDP to a certain extent but after a limit is achieved it would show a declining trend. This can be because of a number of factors, most important and prominent of which can be the monetary and fiscal policies of the government. With the inflow of remittances, the households are left with more income at their disposal. This will lead to increased consumption, savings and investment. Remittances will also

lead to appreciating of the exchange rate which will reduce the trade competitiveness of the economy. The government will take corrective measure to fix the problem which will eventually affect the developmental impact of remittances on the economy. At the same time exchange rate and the level of inflation currently prevailing in the economy influence the real-time impact of the remittances which may determine if remittances will actually lead to growth in the economy or not. Volume wise, remittances may positively impact the GDP and GDP per capita in absolute terms but in the context of GDP growth it may not necessarily have a positive influence.

Governments around the world formulate and implement policies that aim to bring about balance in the economy. Considering that, as can be seen in the Graph 4 that inflation, real interest rate and exchange rate are following a somewhat balanced and constant trend throughout. Reason being that monetary and fiscal policies are basically designed to address these macroeconomic variables and the policies are oriented towards bringing about consistency and control in them so that major economic fluctuation may not take place. These policies can influence how remittances can impact the GDP growth overall.

After having analysed the linearity of the relationship among variables, it is important to assess the impact which is discussed further in the paper but before the model's (GAM) accuracy has been determined. As can be seen in Graph 3 (ACF results) that the residuals are well within upper and lower limits and are not correlated meaning thereby the model is accurately defining the model can be used for reliable predictions, as the residuals do not exhibit significant autocorrelation. And also, the model's specification is effective in capturing the underlying dynamics of the data.

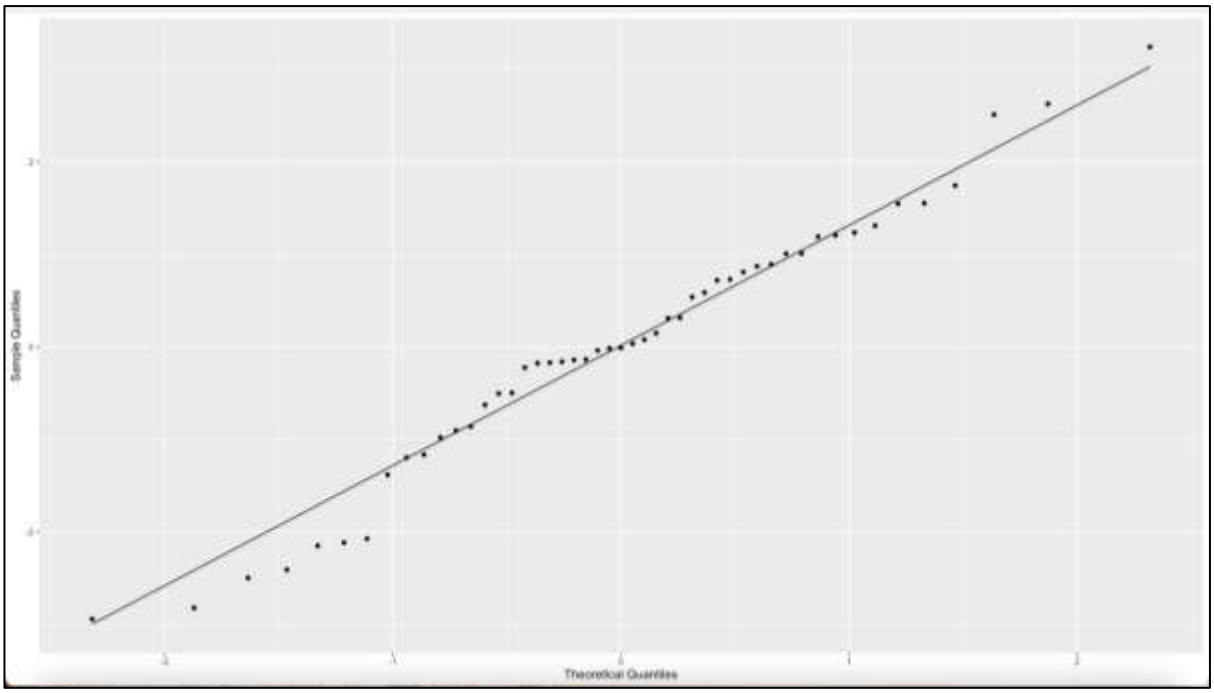
Graph 3: ACF Results



Source: Author's own calculation

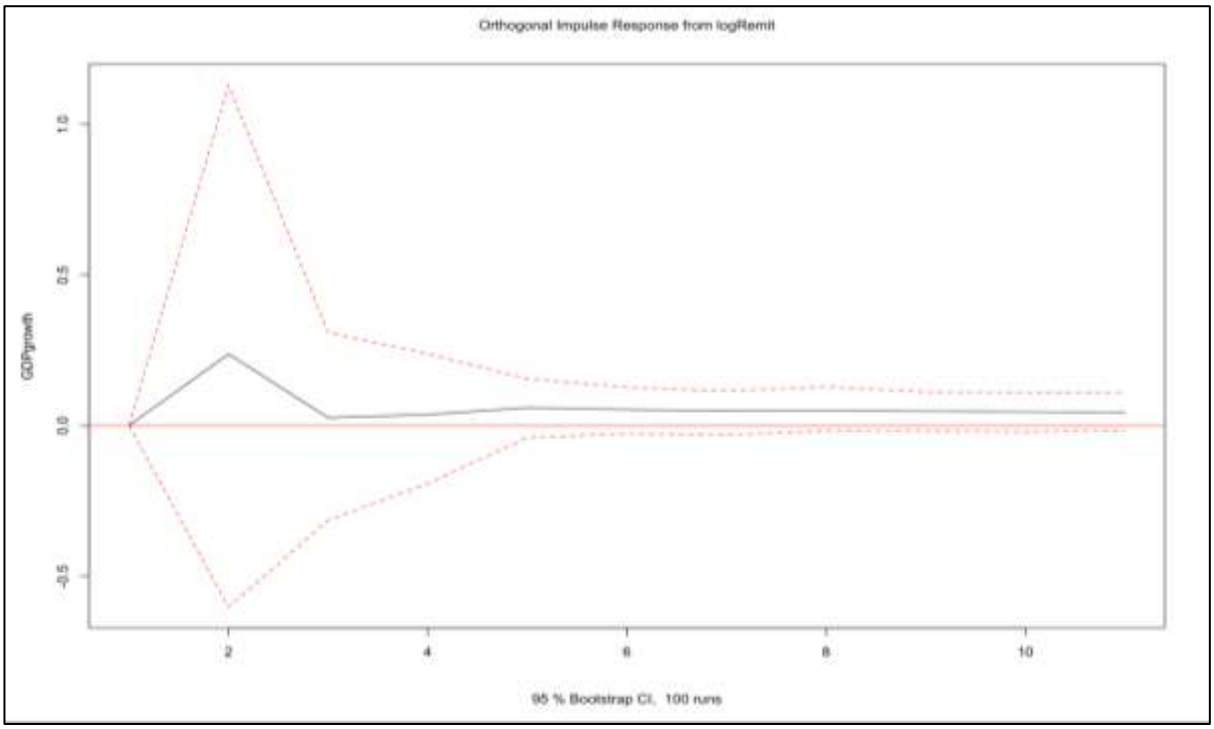
Further Q-Q plot exhibits perfect normality as the dots perfectly follow the diagonal line. The extent to which the dots deviate from the line indicates the degree of non-normality. And all the dots are following the line closely. So diagnostic checks are stating that the model is fit for analysis and can be relied upon

Graph 4: Q-Q Plot



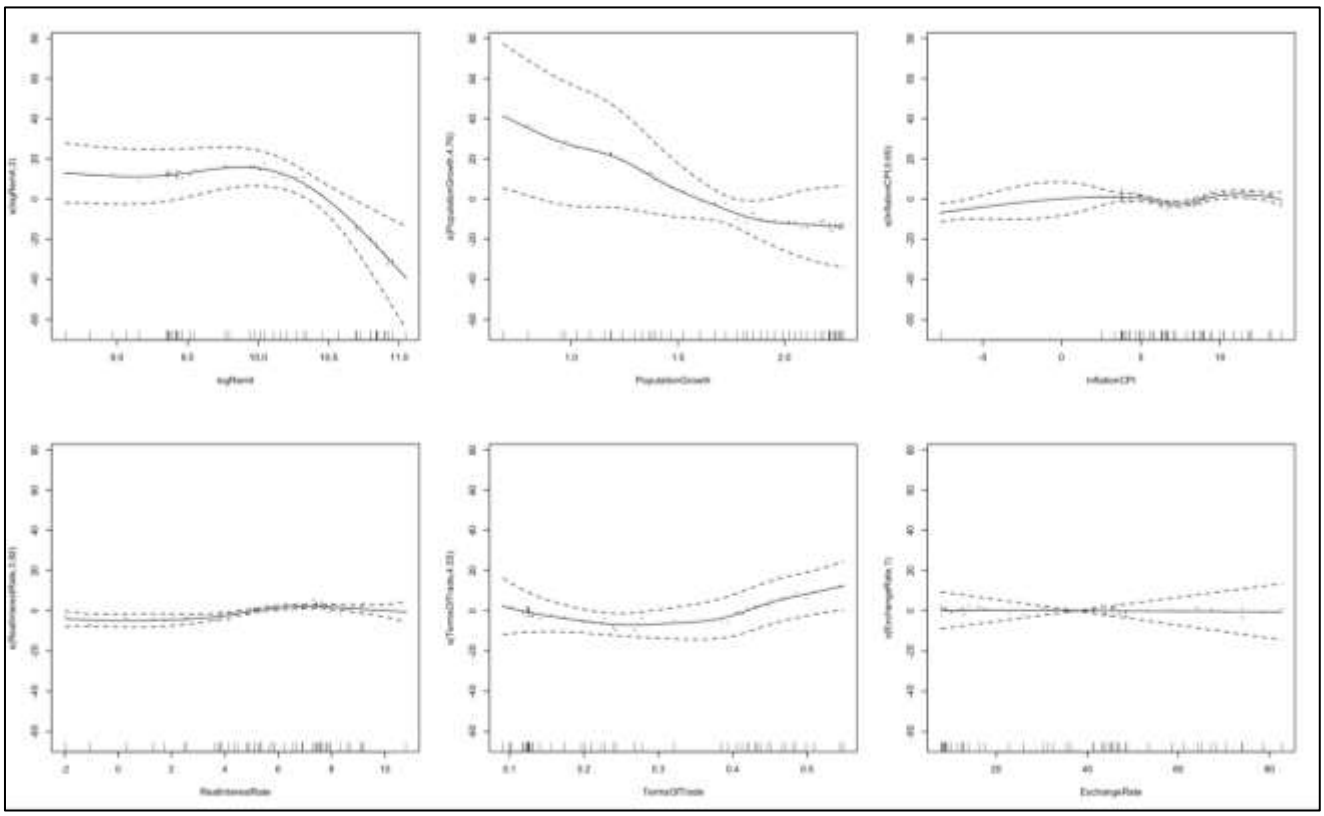
Source: Author's own calculation

Graph 6: Impulse Response Function



Source: Author's own calculation

Graph 5: GAM Component Plot



Source: Author's own calculation

Further, As can be seen the results of Impulse Response Function plot shows the response of GDP growth to a shock in remittances. A positive shock in remittances leads to an initial increase in GDP growth, as indicated by the black line rising above the red intact line. The response is positive but gradually stabilizes over time, suggesting that the impact of remittances on GDP growth is temporary but significant. And the response is consistently positive, although the magnitude of the response may vary over time. The findings of IRF accommodates that of the results obtained using GAM that initially the impact of remittances on GDP growth is positive but after a point it may not be so.

So, to examine the relationship further, impact of remittances individually and in interaction with Real interest rate has been analysed to assess the magnitude and direction of the change (the results along with all the diagnostic test are shown in the Appendix). In short-run the impact of remittances on GDP growth is negative while in long-run the impact is positive but insignificant. The impact of real interest rate on GDP growth is negative throughout in short as well as in the long-run. Further it can be seen that the impact of population growth on GDP growth is positive in current period and second lag period while in the first and third lag period it is negative in short-run and in the long run the impact of the same on GDP growth is positive in current and second lag period and negative in first and third lag period. Similarly, the impact of inflation on GDP growth is positive only in the current lag period and in the first, second and third lag it is negative in the short-run. In the long-run it is showing a dynamic relation with positive results at certain points. Terms of trade has positive influence on the GDP growth throughout in short as well as in the long run. In the same way the impact of exchange rate is negative throughout in the short and long-run. But what is important here is the kind impact that the interactive term of remittances and Real Interest Rate (Intt*Remitt) has which positive throughout in short as well as in the long-run. The positive impact

of the interactive term (Intt*Remitt) suggests that remittances can mitigate the negative effects of high real interest rates on GDP growth. This implies that remittances can play a crucial role in supporting economic growth, especially in environments with high interest rates.

To break-down these findings further it can be seen that the negative impact of remittances on GDP growth in the short run is unexpected, as remittances are often considered a stabilizing factor for economies. However, positive but insignificant impact of remittances in the long-run may suggest that remittances are not being utilized effectively for productive purposes. The consistently negative impact of real interest rates on GDP growth suggests that higher interest rates may dampen economic growth which is mitigated or rather offset by the remittances. Implying that the economies with significant remittance inflows may be more resilient to monetary policy tightening. Since India despite receiving the highest amount of remittances is not dependent on it as can be seen with its proportion in the GDP which is less than 4%, it is potentially not a very strong influence on the growth of GDP. When seen the results of GAM and ARDL combined with the additional interactive variable gives a very comprehensive picture of the role of remittances in the monetary policy transmission mechanism. The possible layout of which could be when there is inflow of remittances, it adds to the existing money flow in the economy and the disposable income of the receiver. This way it will induce the policy makers to implement policies that would manage the inflation and exchange rate effectively now these will be done using the monetary policy instruments, and one of the widely used instrument is the Real Interest Rate. That is why it has been taken alongside remittances in the model individually and in interaction with the remittances. And is showing a positive impact on the GDP growth throughout in short as well as the long run. Meaning thereby remittances act effectively alongside monetary policy instruments in the monetary policy transmission mechanism.

Conclusion

The results indicate that remittances positively impact GDP growth up to a certain threshold, beyond which the effect declines and may even become negative indicating a non-linear relationship. The Impulse Response Function also confirms this finding, showing a temporary but significant positive response of GDP growth to remittance shocks. Monetary and fiscal policies play a crucial role in determining the impact of remittances on GDP growth. So, considering the non-linear relationship between remittances and GDP growth, it can be seen that despite the fact India tops the list of remittances receiving nations but the proportion of remittances received in terms of GDP is however less and GDP is influenced by a number of other factors. Given the inadequate proportion of Remittances as percentage to GDP it can be said that remittances can contribute to economic growth, they are not a panacea for economic development in case of India. Instead, they should be considered as one of several factors that can influence GDP growth, alongside other macroeconomic variables and policy interventions as there may be active components that would impact the GDP growth. It further depends on the monetary policy which ultimately determines how the remittances are going to impact the economy at macroscopic level. And further in the analysis it is seen in the results obtained using ARDL show that remittances actively participate in the monetary policy transmission mechanism and help mitigating the negative effects of real interest rates. For instance if high interest rates can reduce the borrowings, spendings and investment, the gap created thereby due to high interest rate can be filled with remittances.

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