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The Role of Migration and Foreign Remittances in Bangladesh's Economic Growth: An Empirical Analysis

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ABSTRACT

Migration and foreign remittances have emerged as one of the most significant economic factors in Bangladesh in recent years due to their influence on economic growth. This study examines the intricate relationship between GDP and foreign remittances in Bangladesh over the period 1980–2022, using time series data and econometric methods. The analysis relies on secondary data from reputable sources, including the Bangladesh Economic Review (BER), Bangladesh Bank, and the Bangladesh Bureau of Statistics (BBS). A Vector Error Correction Model (VECM) was employed to assess long-term and short-term relationships between the variables. The results reveal a positive long-term relationship between foreign remittances and GDP, highlighting the crucial role remittances play in Bangladesh's economic growth. However, migration exhibits a negative correlation with GDP in the long run. The Granger Causality Test indicates that foreign remittances have a unidirectional causal effect on GDP in the short term, but migration does not significantly influence GDP in either direction. The findings suggest that while remittances are a key driver of short-term growth, migration's long-term effects on economic output require more strategic policy intervention. Based on these results, the study recommends that Bangladesh's government enhance its policies on remittance management, invest in skill development for migrant workers, and develop labor export strategies to maximize the benefits of remittances for sustainable economic growth.

1. Introduction

Human migration refers to the movement of people from one location to another for purposes such as permanent or temporary residence and employment. This process has been a defining feature of human history, beginning with the movement of early human groups out of East Africa (Tigno, 2006). Migration is inherently complex, involving dynamic flows that continually shift. The diverse contexts and types of migration make it challenging to develop all-encompassing theories and generalizations (Zeitlyn, 2006). Broadly, migration can be classified into two categories: internal and international. Among these, international migration has evolved into a significant global phenomenon.

Bangladesh, a country with a substantial labor surplus, plays a prominent role in the supply side of the global labor market (Refugee and Migratory Movement Research Unit, 2008). The country has a long history of migration and is one of the major labor-exporting nations worldwide. Each year, a considerable number of Bangladeshis voluntarily migrate overseas, either for long-term or short-term employment (Siddiqui, 2005). Despite this long-standing history, the rise in oil prices during the 1970s significantly expanded opportunities for Bangladeshi migrants in the Middle East. This trend later extended to newly industrialized nations in Southeast Asia (Siddiqui, 2003).

During the 1990s and beyond, a growing trend emerged of Bangladeshis seeking employment in developed countries such as the United States, Canada, and Italy, as well as in Asian nations like Japan, Malaysia, and Singapore (Siddiqui, 2003). This migration trend was further encouraged by the Bangladeshi government, which has promoted international labor migration as part of its broader development strategy since 1976 (Refugee and Migratory Movement Research Unit, 2007). As a result, Bangladesh became a major source of migrant labor during the 1980s (Mannan, 2001; Saha, 2024; Lubna & Saha, 2024). Over time, international migration has become intricately woven into the country's economic, social, and political structures.

One of the most visible outcomes of international

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migration is the flow of remittances. Remittances are earnings sent by migrants from their destination countries to their places of origin. These transfers, which typically consist of monetary or other cash payments, provide crucial financial support to families and communities in migrants' home countries. Migration from Bangladesh is not a new phenomenon; the country has a long history of overseas migration and the resulting remittances, dating back to 1942 (Mahmood, 1991).

From 1979 to 2008, the inflow of remittances to Bangladesh increased at an average annual rate of 19 percent (Hussian & Naeem, 2009). Between 1976 and 2010, approximately 7.1 million people temporarily emigrated from Bangladesh. Since 2009, Bangladeshi migrants have sent home more than USD 10 billion annually, which accounts for slightly more than 10% of the country's GDP. Today, Bangladesh ranks among the top 10 remittance-recipient countries globally. According to a report by Bangladesh Bank and BMET (2019), the country was the eighth highest recipient of foreign remittances in 2019, with a total of USD 18.35 billion. This placed Bangladesh third in South Asia, following India (USD 83.3 billion) and Pakistan (USD 22.25 billion). Remittances have become a critical component of Bangladesh's economy. They not only help alleviate poverty but also stimulate consumption and investment, playing a crucial role in the nation's economic development. Remittances have been instrumental in generating employment and sustaining the balance of payments by bringing in foreign currency, thereby supporting the overall financial stability of the country.

Remittances can fight poverty, stimulate consumption and investment and decrease labor force (Saha, 2025; Saha, 2023; Fayissa and Nsiah, 2008). Remittances are a major instrument to generate employment as well as boosting economic growth of developing countries like Bangladesh. It also helps to sustain the balance of payments (BOP) by bringing in foreign currency (World Bank). Whether there is a connection between these two economic variables - remittance and economic growth is important to find for the developing nations of Bangladesh.

Migration and the flow of foreign remittances have become central aspects of Bangladesh's economy. Over the past few decades, migration has not only contributed to economic growth but has also reshaped the socio-economic landscape of the country. Bangladesh, with its large labor force and limited domestic employment opportunities, has experienced significant outward migration, particularly to the Middle East and Southeast Asia (Saha, 2025; Saha, 2024). As a result, foreign remittances have grown steadily and have become a critical source of income for millions of families. This study explores the relationship between migration, foreign remittance, and economic growth in Bangladesh through an econometric lens, aiming to uncover the nuances of this dynamic interaction.

Bangladesh has a long history of labor migration, dating back to the 1970s, when large-scale migration began, primarily to oil-rich Gulf countries. Over time, this trend has expanded to other regions, with Bangladeshi workers now found in Europe, North America, and East Asia (Lubna & Saha, 2024; Saha, 2023). According to the World Bank, Bangladesh is one of the top recipients of foreign remittances globally, with remittance inflows accounting for around 6% to 8% of the country's Gross Domestic Product (GDP). This influx of remittances has been crucial in poverty alleviation, improving household income, and contributing to the national reserves.

The importance of migration and remittances in Bangladesh cannot be overstated. On the microeconomic level, remittances enable households to invest in education, healthcare, housing, and small businesses (Saha, 2024; Akter *et al.*, 2024). On the macroeconomic level, remittances serve as a buffer against external economic shocks, such as natural disasters, which Bangladesh is particularly vulnerable to. Moreover, remittances contribute to increasing foreign exchange reserves, stabilizing the currency, and reducing the country's dependency on foreign aid (Saha, 2022).

Despite these significant benefits, the relationship between remittance flows and economic growth in Bangladesh is not entirely straightforward. While remittances contribute to consumption and investment, they may also create challenges, such as the risk of over-reliance on external sources of income and the potential for 'brain drain,' where skilled labor leaves the country. Furthermore, the global economic downturns and changing labor market dynamics in destination countries can lead to fluctuating remittance inflows, affecting the stability of the Bangladeshi economy.

Migration and foreign remittances have become central components in the economic narrative of Bangladesh, playing a transformative role in both macroeconomic stability and household welfare. The study is highly significant as it explores these dynamics and offers an empirical understanding of how remittance flows, driven by migration, shape the country's economic trajectory. In an economy like Bangladesh, where traditional sectors face structural limitations, migration and remittances provide a valuable supplement, and this study aims to quantify that contribution within a rigorous analytical framework.

Firstly, understanding the impact of migration and foreign remittances is essential for policymakers seeking to optimize the benefits of remittances. Bangladesh ranks as one of the largest recipients of foreign remittances globally, primarily due to its large migrant workforce, particularly in Gulf countries and Southeast Asia. These remittances represent a critical source of foreign currency, helping stabilize the national currency and alleviate the balance of payments deficit. However, while foreign remittances are visibly significant, their exact contributions to economic growth and development are less understood and are often considered only in broad terms. By conducting an empirical analysis, this

study provides specific, data-backed insights into the relationship between remittances and GDP growth, potentially influencing future economic planning and policies for better resource allocation.

Moreover, this study holds significant value for understanding poverty alleviation and income distribution in Bangladesh. Remittances directly support household incomes, particularly in rural areas where job opportunities are scarce, and economic diversity is limited. The inflow of remittances has been shown to improve access to essential services such as education, healthcare, and housing, which leads to enhanced human capital development and reduced poverty levels. Empirical analysis can shed light on whether and to what extent remittances contribute to poverty reduction and income equality, enabling policymakers to better tailor social protection programs and regional development strategies.

Additionally, this study is significant for its potential to inform financial and banking sector policies. A large portion of remittance flows into Bangladesh through formal banking channels, making the financial sector a key player in managing and facilitating remittance transfers. The study's findings could reveal insights on the effectiveness of these formal channels and how remittances impact financial sector health and stability (Saha, 2025; Saha, 2024). With such information, policymakers can develop targeted measures to strengthen remittance management, promote the use of formal channels, and support financial inclusion efforts. Expanding access to formal banking services can help maximize the economic utility of remittances, ensuring that remitted funds are efficiently channeled into productive investments.

Another significant contribution of this study lies in its potential to highlight the role of remittances in rural development and urbanization patterns. In many developing countries, remittances have fueled both rural development and internal migration, as families move towards urban centers seeking better economic opportunities supported by remittance income (Saha, 2025; Saha, 2023). For Bangladesh, where urbanization is rapidly increasing, understanding how remittances affect urban and rural divides, land use patterns, and housing markets is critical. By empirically examining these impacts, this study may provide valuable insights for sustainable urban development policies and rural revitalization programs, helping reduce regional inequalities and supporting balanced national development (Saha, 2025).

The study is also valuable from a social perspective, as it can provide a deeper understanding of the demographic dynamics and social impacts of migration. Migrant workers in Bangladesh often face social challenges related to family separation and the adjustment issues arising from transnational lifestyles. While remittances support family incomes, the social costs and psychological effects on migrant workers and their families are often overlooked (Saha, 2024; Saha, 2023). An empirical analysis of remittances' broader impact on household welfare may offer a more holistic view of migration's role in economic growth and social stability. By understanding the social costs associated with migration, stakeholders can design more effective support systems for migrant families, including social services, counseling, and reintegration programs for returning migrants (Saha, 2022).

Furthermore, this study has a global and comparative significance. Migration and remittance flows are critical topics for numerous developing countries, and the findings from Bangladesh could offer insights applicable to other nations with similar economic structures and migration patterns (Saha, 2025; Saha, 2022). By empirically analyzing the contribution of remittances to Bangladesh's economy, this study can contribute to a broader understanding of how remittance-dependent economies function and what lessons other countries might draw (Saha, 2023). Comparative analyses can be made with other countries in South Asia, Latin America, and Africa, where remittances similarly drive household incomes and economic growth.

Finally, the empirical approach of this study lends academic and practical value by filling a gap in quantitative research on remittances and economic growth in Bangladesh (Saha, 2024; Saha, 2022). While many studies acknowledge the significance of remittances, empirical analyses that quantify their specific impact on economic indicators like GDP, poverty rates, and investment levels remain limited. This research provides a data-driven basis for future studies, policy analyses, and economic forecasting, enriching the academic literature on migration economics and offering a model for subsequent studies in the field.

This study's exploration of the relationship between migration, remittances, and economic growth in Bangladesh holds immense significance. By providing empirical evidence on the positive and negative aspects of remittance flows, this research contributes to more informed policy formulation, particularly in economic, social, and financial sectors (Saha, 2022). Understanding how remittances drive economic growth and the specific ways they benefit or challenge the national economy will help Bangladesh harness the full potential of migration and remittances as tools for development (Saha, 2023). This, in turn, can support the country's journey toward sustainable economic growth and social prosperity, making the study not only valuable for academic discourse but also essential for national development strategy.

This study aims to assess the impact of migration and foreign remittances on the economic growth of Bangladesh by employing econometric techniques. Specifically, the objectives of the study are:

1. To examine the short-term and long-term effects of foreign remittances on Bangladesh's economic growth.
2. To investigate whether there is a causal relationship between migration-induced remittance flows and key economic indicators such as GDP growth, investment, and household consumption.
3. To identify the challenges and opportunities presented by remittance flows in enhancing sustainable economic development in Bangladesh.

While foreign remittances have undoubtedly benefited Bangladesh's economy, there is a need to analyze their effectiveness in fostering long-term sustainable growth. The cyclical nature of migration, the dependency on a few key labor markets, and the possibility of stagnating domestic economic sectors due to remittance reliance all present critical issues that need to be addressed. This study seeks to explore whether remittance inflows are being effectively channeled into productive investments that contribute to broad-based economic growth, or if they primarily fuel short-term consumption, without addressing structural economic weaknesses.

The study employs an econometric analysis using time-series data from Bangladesh over several decades. Key variables such as GDP growth, foreign remittance inflows, investment rates, and labor market participation will be analyzed using regression models to identify both short-term and long-term effects. Causality tests, such as the Engle-Granger causality test, will also be applied to examine the directional relationship between remittances and economic growth.

In conclusion, the interplay between migration, foreign remittances, and economic growth is a vital topic for understanding the economic trajectory of Bangladesh. This study will contribute to the ongoing discourse on how Bangladesh can leverage remittance inflows to achieve sustainable economic development, while also addressing the potential risks associated with an over-reliance on external income sources.

1.2. Hypothesis of the Study

The study seeks to test the following hypotheses:

1. H0: There is no relationship among migration, foreign remittance and economic growth in Bangladesh.

   H1: There is a positive relationship among migration, foreign remittance and economic growth in Bangladesh.

2. H0: There is no enduring relationship among migration, foreign remittance and economic growth in Bangladesh.

   H1: There is a sustained relationship among migration, foreign remittance and economic growth in Bangladesh.

3. H0: Migration and foreign remittance do not contribute positively to the enhancement of economic growth in Bangladesh.

   H1: Migration and foreign remittance play a positive role in enhancing economic growth in Bangladesh.

Significance and implications of the study

The study is of critical importance in understanding how migration-driven remittances impact the economy of Bangladesh, both directly and indirectly. As one of the world's largest recipients of foreign remittances, Bangladesh has relied on the income generated by its migrant workers to bolster its foreign exchange reserves, alleviate poverty, and contribute to macroeconomic stability. This study is essential not only to quantify these impacts but also to offer insights into optimizing the use of remittances for sustainable development and inclusive economic growth. By exploring the multifaceted role of remittances, this study can inform policy decisions, provide recommendations for maximizing the economic utility of remittances, and support long-term strategies for socio-economic development.

A primary reason this study is essential is its ability to quantify the contributions of remittances to Bangladesh's GDP, foreign exchange reserves, and macroeconomic stability. Bangladesh relies heavily on remittances, which constitute a significant portion of its GDP and play an important role in offsetting the country's trade deficit. Remittances support Bangladesh's currency value by adding to foreign reserves and providing stability amid fluctuations in exports and imports. An empirical analysis of this relationship provides an evidence-based approach to understanding the macroeconomic benefits of remittances. Policymakers can use this quantitative information to make informed decisions on labor export policies, exchange rate management, and trade policies that maximize the benefits of remittance inflows for national economic stability.

The study holds high relevance for poverty alleviation policies, as remittances are a critical source of income for low-income families, particularly in rural Bangladesh. Many migrant workers remit money back to support their families, who rely on this income for essential needs such as food, healthcare, and education. Remittances thus play a crucial role in reducing poverty and improving household welfare. By analyzing data on household expenditures, this study can determine how remittances influence consumption patterns, investment in human capital, and overall standards of living. The findings can inform poverty reduction strategies, social protection programs, and targeted development initiatives that prioritize regions heavily dependent on remittance income.

Bangladesh has increasingly encouraged the use of formal banking channels for remittance transfers, with the government implementing policies and incentives to reduce informal transfers. This study is important for evaluating the impact of formal remittance flows on the financial sector, as increased remittances through formal channels can boost liquidity, support bank profitability, and enhance financial inclusion. The study's findings may reveal whether current policies are effective in encouraging the use of formal channels, thereby supporting financial stability. Insights from this research could help shape future financial policies, including incentives for remittance-sending, digital payment options, and financial literacy programs to ensure remitted funds are securely and efficiently managed.

The study also has significant implications for understanding the socio-economic impact of remittances on both urban and rural communities in Bangladesh. Remittances contribute to regional development by providing income to rural areas, where employment opportunities are scarce. Families receiving remittances often invest in building homes, establishing small businesses, or purchasing land, thereby stimulating local economies. Furthermore, remittance income can reduce

migration pressure within Bangladesh, as remittances enable families to improve their standard of living without needing to move to urban centers. This study's exploration of how remittances contribute to regional and social development can guide policy recommendations for balanced economic growth across regions, reducing urban-rural disparities, and supporting local economies.

This study is important for highlighting the role of skilled and unskilled labor migration in driving economic growth. Migrant workers from Bangladesh are predominantly employed in low-skilled jobs abroad, which often limits their earning potential. By analyzing the relationship between the skill level of migrant workers and the remittances sent back to Bangladesh, the study can offer insights into the potential benefits of investing in skill development. Enhancing the skill level of migrant workers can increase their earning potential and lead to higher remittance volumes. This study may recommend investment in technical and vocational training for prospective migrant workers, which can lead to better-paying job opportunities, improved remittance inflows, and greater contributions to economic growth.

While remittances have an immediate positive effect on household welfare and consumption, this study can explore their potential for contributing to long-term economic growth through productive investments. Remittances are often used for consumption rather than investment, meaning that much of the money is spent rather than saved or invested in income-generating activities. This study could examine the factors that influence how remittances are used and identify ways to encourage productive investment in sectors such as small businesses, real estate, and education. Findings from this research could lead to policies that encourage remittance recipients to invest in businesses, savings, or education, thereby fostering entrepreneurship, job creation, and sustainable economic growth.

The study is currently of high relevance due to the shifting trends in global migration patterns, economic challenges in destination countries, and the evolving dynamics of remittance flows. Migration and remittances are pivotal to Bangladesh's economy, providing critical foreign exchange, supporting household incomes, and influencing economic stability. However, recent economic and geopolitical shifts are impacting the flow of migration and remittances, necessitating a fresh analysis of their effects on Bangladesh's economic growth.

Remittances continue to be a major contributor to Bangladesh's GDP, with recent data showing an increase in remittance inflows. Despite occasional fluctuations, the trend has been largely upward, thanks to sustained migration levels and improved remittance channels. Bangladesh received around USD 21.6 billion in remittances in the fiscal year 2023-24, a figure that highlights the importance of remittances as a stable and reliable source of foreign exchange for the economy.

The global economy has been facing downturns due to inflation, rising interest rates, and geopolitical tensions, all of which affect migrant workers' income and job security, particularly in key remittance-sending regions like the Middle East. Economic slowdowns in these host countries have implications for migrant earnings and, consequently, remittance flows back to Bangladesh. A slower rate of remittance growth could impact economic growth in Bangladesh, especially if the current trend persists.

The COVID-19 pandemic significantly impacted migration flows as many migrant workers faced job losses or were forced to return to Bangladesh. However, the post-pandemic recovery in many destination countries has led to an increased demand for migrant labor, particularly in the Gulf Cooperation Council (GCC) countries. This rebound has helped stabilize remittance inflows, which are gradually increasing as more Bangladeshis migrate for work.

Over recent years, Bangladesh has made significant progress in directing remittances through formal banking channels. This shift has been encouraged by government incentives, digital financial solutions, and policies aimed at discouraging informal money transfers (hawala/hundi). With more remittances flowing through official channels, Bangladesh's banking sector benefits from increased liquidity, supporting broader financial stability and economic growth.

The Bangladeshi government has been proactive in supporting migration and enhancing remittance flows. Policies include financial incentives for remittance-sending, vocational training programs for migrants, and bilateral agreements with host countries to ensure better working conditions. These initiatives have contributed to higher remittance volumes and offer a sustainable strategy for maximizing the benefits of migration for economic development.

Remittances continue to play an important role in household welfare, particularly in rural areas where employment opportunities are limited. Remittance income helps families access better education, healthcare, and housing, leading to long-term benefits for human capital development. This impact on household welfare is especially critical as Bangladesh grapples with inflation and rising costs of living.

While remittances contribute positively to the economy, migration remains fraught with challenges. Many Bangladeshi migrant workers face uncertain working conditions, lower-than-expected wages, and lack of social security. Additionally, high recruitment costs and exploitation by intermediaries can deter migration, especially for workers in low-skilled jobs.

Bangladesh has been experiencing inflation and currency depreciation, which impacts the real value of remittances received. While remittances bring in foreign exchange, the local purchasing power of this income may be reduced due to higher prices of goods and services. This economic dynamic can reduce the ability of remittance-receiving households to maintain their standard of living.

There is a growing trend of skilled workers migrating

from Bangladesh, especially to higher-income countries. Skilled migration has the potential to bring in higher remittance levels and expose workers to greater knowledge and technology. However, the "brain drain" associated with skilled migration is also a challenge, as it can lead to shortages of skilled labor within Bangladesh.

The future of remittances in Bangladesh remains promising, given the global demand for migrant labor and government support for the sector. However, shifts in global migration policies, automation in labor-intensive sectors, and the geopolitical situation could pose challenges to maintaining high remittance flows. Additionally, Bangladesh must consider strategies to diversify income sources to reduce dependency on remittances for economic stability.

The current situation emphasizes the significance of remittances as a stabilizing factor in Bangladesh's economy. Remittances have helped Bangladesh maintain a steady inflow of foreign exchange, essential for reducing the trade deficit and supporting currency stability. However, reliance on remittances also brings risks, especially given the global economic uncertainties that affect migrant employment and earnings abroad.

Understanding the evolving relationship between migration, remittances, and economic growth is crucial for future policy planning in Bangladesh. As the country aspires to transition from a lower-middle-income to an upper-middle-income economy, careful attention to these dynamics will enable policymakers to strengthen the benefits of migration while addressing the associated challenges.

Finally, this study is essential for addressing the challenges and risks associated with migration and remittances, such as labor exploitation, high recruitment costs, and vulnerability to economic fluctuations in host countries. Many Bangladeshi migrant workers face challenging work conditions abroad, and some may not receive fair wages or face difficulties repatriating their earnings. The study's findings could provide insights into how policies and regulations can be strengthened to protect migrant workers' rights, support their families back home, and mitigate the risks associated with economic downturns in destination countries. It may also provide evidence to support bilateral agreements between Bangladesh and major labor-importing countries, ensuring better protection and benefits for migrant workers.

The study on is of great importance in understanding how remittances drive economic progress and social welfare in Bangladesh. This research provides valuable insights into the macroeconomic benefits of remittances, their role in poverty alleviation and household welfare, the impact on financial sector development, and the potential for long-term investments. Furthermore, the study sheds light on the socio-economic and regional development implications of remittances, while addressing key challenges faced by migrant workers. By empirically analyzing these factors, this study contributes to both academic literature and practical policy recommendations, enabling Bangladesh to leverage remittances effectively for sustainable and inclusive economic growth.

2. Literature Review

The relationship between migration, foreign remittances, and economic growth has been extensively studied in both global and Bangladeshi contexts. The literature underscores the importance of remittances as a significant driver of economic growth, poverty alleviation, and household development in developing countries, especially for nations with high rates of labor migration. However, much of this literature lacks a detailed econometric investigation of the long-term and short-term dynamics between migration, remittance inflows, and macroeconomic growth. This review synthesizes key studies that explore these relationships, highlighting their findings and identifying gaps addressed by this study.

Globally, remittances are recognized as a key component of the development process, particularly in developing economies. Meyer and Shera (2016) analyzed the impact of remittances on economic growth across several high-remittance-receiving countries using panel data from 1999 to 2013. They found that remittances contribute positively to economic growth, fostering domestic consumption and investment. Jawaid and Raza (2010) and Saha (2024) examined the long-term effect of remittances on economic growth in five South Asian countries—Bangladesh, India, Nepal, Pakistan, and Sri Lanka—finding a positive impact in most countries, although results varied by region.

Similarly, Das and Chowdhury (2011) conducted a comparative analysis of 11 developing countries using panel cointegration techniques and found that remittances have a long-term positive effect on economic growth. However, while these studies highlight the importance of remittances, they often do not account for the structural differences in how migration and remittances influence growth over time. Many studies also lack a country-specific focus on Bangladesh, where remittances play a unique role in the economy due to the country's large expatriate workforce.

Bangladesh has been one of the largest labor-exporting countries in South Asia, with remittances playing a crucial role in its economic development. Islam (2012) explores the socioeconomic benefits of remittances in Bangladesh, analyzing data from 1976 to 2010. His study highlights the pivotal role remittances play in poverty reduction and household development. He also emphasizes the critical contribution of remittances to the national economy, particularly in rural areas where remittances provide a lifeline for low-income households.

Chowdhury *et al.* (2010); Saha and Saha (2023) investigate the relationship between remittances and economic growth in Bangladesh using data from 1990 to 2010. Their findings reveal a strong positive correlation between remittances and GDP growth, asserting that remittances significantly enhance the balance of payments, boost foreign reserves, and promote investment and savings.

This study further concludes that remittances reduce unemployment and reliance on foreign aid, underscoring their long-term importance for economic sustainability.

In a similar vein, Alam (2012) conducted a time-series analysis of remittances and their impact on GDP and private investments in Bangladesh from 1976 to 2010. The results demonstrate a positive correlation between remittances and both private investment and GDP, suggesting that remittances not only spur economic growth but also improve human capital, indirectly influencing long-term development. However, Alam's study did not examine the bidirectional causality between remittances and GDP, a gap that the present study aims to address.

Hadi (1999) explores the effects of overseas migration on rural communities in Bangladesh, noting that migration provides a critical outlet for the unemployed and a source of substantial remittances. His study highlights the social and economic benefits of remittances but does not delve deeply into their macroeconomic effects on GDP growth or the role of migration in shaping long-term development patterns. Similarly, Wadood and Hossain (2015), Saha (2022), Saha and Saha (2023) examined the relationship between remittances and economic growth using time-series data from 1972 to 2013, employing econometric tools like Granger causality and VECM. Their study found a long-term causal relationship between remittances and economic growth, confirming the critical role of remittances in sustaining Bangladesh's economic progress.

Although numerous studies have examined the role of remittances in Bangladesh's economy, most of them focus either on the short-term impact or lack a robust econometric analysis that incorporates both migration and remittance flow into the broader economic framework. Furthermore, the existing literature often overlooks the effects of global shocks, such as the COVID-19 pandemic, which has drastically altered migration patterns and remittance inflows in recent years. Few studies examine the negative aspects of migration, particularly how outward migration can drain the labor force and potentially hinder long-term economic growth. Most research tends to emphasize the benefits of remittances without sufficiently exploring the complex relationship between migration, labor supply, and economic performance.

Moreover, while studies like those by Chowdhury *et al.* (2010), Saha (2023) and Islam (2012) underscore the importance of remittances, they do not fully explore the causal relationships between migration, remittance flows, and economic growth. Specifically, many fail to use modern econometric tools, such as cointegration analysis or Granger causality tests, which can reveal both short-term and long-term dynamics.

This study aims to fill these gaps by employing advanced time-series econometric techniques, including the Unit Root Test, Johansen Cointegration Test, and Granger Causality Test with a Vector Error Correction Model (VECM). The analysis covers a more extended period (1980–2022) than most previous studies, allowing it to capture the long-term trends and account for significant events, such as the COVID-19 pandemic. By examining the relationship between migration, remittances, and economic growth over both short- and long-term horizons, the study provides new insights into the intricate dynamics of these variables.

Additionally, the study differentiates between the positive effects of remittances and the potential negative impact of large-scale migration, offering a more nuanced understanding of how these forces interact in the context of Bangladesh's economy. The use of modern econometric techniques enables a more precise analysis of causal relationships, addressing the limitations of prior studies that relied on simpler correlation analyses.

In summary, the existing literature establishes the importance of migration and remittances in driving economic growth in Bangladesh, but it leaves several gaps unaddressed. This study contributes to the field by providing a detailed econometric analysis of the long-term and short-term impacts of both migration and remittances on Bangladesh's economic growth. By covering a more recent and extended timeframe, and by using advanced econometric techniques, this research aims to provide policymakers with more actionable insights into how migration and remittances can be leveraged for sustained economic development.

The existing literature highlights the critical role that remittances and migration play in driving economic growth, particularly in developing countries. However, gaps remain in understanding the causal relationships among migration, remittances, and economic growth, particularly in Bangladesh. This study aims to address these gaps by analyzing the trends and impacts of migration and remittances on economic growth in Bangladesh between 1980 and 2022. Using advanced econometric techniques such as Unit Root, Cointegration, and Granger Causality tests, the study will offer insights into the short- and long-term effects of remittances and migration on the Bangladeshi economy, along with policy recommendations based on the findings.

Despite the extensive body of research on migration, remittances, and economic growth, there are still significant gaps in understanding their interconnections, particularly in the context of Bangladesh. Most existing studies either focus on the individual impacts of remittances or migration but seldom analyze both in relation to overall economic growth using modern econometric techniques. Moreover, prior research often concentrates on short-term relationships and lacks a comprehensive examination of long-term causality, as well as the interplay between migration, remittances, and economic development in Bangladesh. Additionally, while several studies have covered earlier periods, they fail to account for more recent global events, such as the COVID-19 pandemic, which significantly affected migration patterns and remittance flows. Furthermore,

many existing studies on this topic do not fully employ robust econometric tools like Vector Error Correction Models (VECM), Granger Causality, and Johansen Cointegration, which could better capture the dynamic relationships between these variables.

This study makes several unique contributions to the existing literature on migration, remittances, and economic growth. First, it provides a comprehensive analysis of the relationships between migration, foreign remittances, and GDP growth in Bangladesh using advanced econometric techniques, including the Unit Root Test, Johansen Cointegration, and Granger Causality with VECM. This methodological approach offers a more accurate understanding of both short- and long-term effects, addressing gaps in prior research that focused primarily on simpler or more static relationships. Second, by covering the period from 1980 to 2022, the study includes more recent data, allowing for the analysis of critical events such as the COVID-19 pandemic, which profoundly influenced global migration and remittance flows. This enables the study to explore how shocks like pandemics affect the migration-remittance-growth relationship in Bangladesh.

Third, the study sheds light on the structural differences between remittances' impact on economic growth and migration's impact, uncovering a nuanced understanding of these variables. It also provides key insights into the reasons behind the observed long-term positive relationship between foreign remittances and economic growth, and the negative relationship between migration and GDP, particularly in times of global disruptions like the pandemic.

The originality of this study lies in its use of modern time-series econometric techniques to investigate both the short- and long-term relationships between migration, foreign remittances, and economic growth in Bangladesh. By employing advanced tools like VECM, Granger Causality tests, and Johansen Cointegration analysis, the study captures dynamic relationships often overlooked in previous research. This approach is innovative in its focus on capturing causalities that are both contemporaneous and persistent over time.

Moreover, the study is one of the few to systematically integrate the effects of recent global events (such as the COVID-19 pandemic) on migration and remittance patterns. By addressing these contemporary developments, it adds fresh and timely insights to the field. Lastly, this research offers specific, actionable policy recommendations for Bangladesh, grounded in empirical findings, which could serve as a framework for other developing nations facing similar migration and remittance challenges. In sum, this study's contribution, originality, and the bridging of key literature gaps offer a more holistic and updated understanding of the inter-relationships between migration, remittances, and economic growth in Bangladesh.

3. Research Methodology

3.1 Data period & Sources of Data

The analysis makes use of Bangladesh's annual time series data on GDP and foreign remittances from 1980 to 2022. Secondary data served as the foundation for every analysis done for this paper. The majority of the information is sourced from the Bangladesh Economic Review (BER), the Bangladesh Bureau of Statistics (BBS), the Bureau of Manpower, Employment and Training (BMET), Bangladesh Bank Annual Reports, Macro trends and other sources. Secondary data will be the primary focus of the analysis. Various statistical methods and instruments will be applied to the data analysis.

3.2 Econometric Framework & Analysis of Data

3.2.1 Model Specification

The time series data set spans forty-three (43) years, from 1980 to 2022. This study's primary goal is to evaluate how external factors—like migration and remittances affect Bangladesh's economic growth and vice versa. The study will also establish the causal relationship between economic growth, migration, and remittances. It will then ascertain how these variables change over time and look for a relationship between them. Consequently, in order to investigate how migration and foreign remittances affect economic growth, we must develop an estimable model.

The estimable equation for empirical purpose is modeled as follows:

$$GDP_t = \alpha_0 + \alpha_1 MIG_t + \alpha_2 FREM_t + \varepsilon_i \quad \ldots\ldots\ldots (1)$$

Where, GDP_t = Gross domestic product, α_0 = Constant term, α_1 , α_2 = Slope of the equation, MIG_t = Migration, $FREM_t$ = Foreign Remittance, ε_i = White noise error term/Residual term, t = Time period.

After taking log value of each variable, the model can be written like this:

$$lnGDP_t = \alpha_0 + \alpha_1 lnMIG_t + \alpha_2 lnFREM_t + \varepsilon_i \quad \ldots\ldots\ldots (2)$$

Where, In is natural logarithm, economic growth is proxied by GDP, MIG is Migration and FREM is foreign remittance and ε is residual term to be normally distributed.

3.2.2 Unit Root Test

The majority of time series variables, according to econometric theory, are non-stationary; thus, adding non-stationary variables to the model may lead to spurious regression, which is unsuitable for precise prediction. A time series' stationarity can be ascertained using the Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and Kwiatkowski, Philips, Schmidt, and Shin (KPSS) unit root tests. The most well-known is the Augmented Dickey-Fuller Test (ADF). We therefore intend to apply the ADF test.

3.2.2.1 Augmented Dickey-Fuller Test

The Augmented Dickey-Fuller (ADF) test is an enhanced version of the basic Dickey-Fuller (DF) test, developed

to address the issue of autocorrelation in the error terms, which may not be white noise in many cases. To correct for this, the ADF test incorporates additional lagged terms of the dependent variable to the model, addressing potential correlations in the error term \(u_t \). The ADF test, introduced by Dickey and Fuller, augments the original DF test by adding lagged values of the variable \(\Delta Y_t \) in situations where the error terms are correlated.

In simpler autoregressive models, this correction is not always necessary, but many macroeconomic time series exhibit complex dynamic structures that a basic autoregressive model cannot capture. For time series with higher-order autoregressive processes (AR(p)), where (p) represents the number of lags, the ADF test provides a more robust framework than the original DF test.

The process of conducting the ADF test is similar to the DF test, but it is applied to an extended model that accounts for more complex lag structures, making it a more reliable tool for testing stationarity in time series data.

$$\Delta y_t = \alpha + \beta_t + \gamma y_{t-1} + \delta 1 \Delta y_{t-1} + \ldots .. + \delta_{p-1} \Delta y_{t-p-1} + \varepsilon_t$$
$$= \alpha + \beta_t + \gamma y_{t-1} + \sum^{p}_{j=1} \delta j \, \Delta y_{t-j} + \varepsilon_t \quad \ldots\ldots\ldots\ldots (3)$$

Where α is a constant, ß is the coefficient of time trend, γ is the coefficient of lagged yt, p is the order of lag of the autoregressive process and εt is the error term that is identically and independently distributed.

3.2.3 Co-integration Test

If the series lacks a steady mean and variance and is non-stationary in time, the regression results will be unclear or unsuitable. Regression results, however, are credible when the stochastic trend is eliminated and stationary residuals are obtained through a linear combination of non-stationary series. Co-integration of the variables is therefore inferred. Additionally, stochastic non-stationary series (p) supporting two or more processes are a prerequisite for co-integration. Co-integration is frequently tested using the Johansen co-integration test. A time series is stationary if it has an I (0) value; if it has an I (1) value, its alteration is stationary but its level is non-stationary. The following is the equation for the co-integration test:

$$p = m - k \quad \ldots\ldots\ldots\ldots (4)$$

Where, p = Stochastic non-stationary series, m = Variables set of time series and k = Linear combination in the number of independents.

There are two ways to conduct the co-integration tests. These are given below:

i. The Trace Test, and
ii. The Maximum Eigen Value Test.

3.2.3.1 Trace Test

The trace statistics determines whether the matrix's rank is r_0. Rank $\Pi = r_0$ is the null hypothesis. That $r_0 \leq rank(\Pi) \leq n$, is an alternative hypothesis, where n is the maximum number of feasible co-integrating vectors. If this null hypothesis is denied in the following test, the next null hypothesis is rank $(\Pi) = r_0 + 1$ and the alternative hypothesis is that $-r_0 + 1 \leq rank(\Pi) \leq n$. The procedure is the same as for the maximum eigen value test.

The probability ratio test statistic is a measure of how likely something is to happen.

$$LR(r_0 n) = -T\sum^{n}_{i=r0+1} In(1-\lambda_i) \quad \ldots\ldots\ldots (5)$$

The likelihood ratio statistic LR (r0, n) is used to evaluate whether rank Π=r versus the alternative hypothesis that rank Π≤n. The likelihood ratio test statistic, for example, compares the hypothesis that ranks Π = 0 to the alternative that ranks Π≤n.

$$LR(0,n) = -T\sum^{n}_{i=1} In\,(1-\lambda_i) \quad \ldots\ldots\ldots\ldots (6)$$

The asymptotic distribution of the statistic is called the trace test of a matrix, based on Brownian motion or typical Wiener processes, hence the name "trace test" (Johansen Econometric, 1995). That doesn't help much; most texts don't attempt to explain the term at all because saying anything more informative requires a lot more explanation. It's possible that the negative will be instructive: The test does not rely on a trace ofrank Π.

3.2.3.2 Maximum Eigen Value

The maximum Eigen value test compares the largest Eigen value to the next largest Eigen value to see if the largest Eigen value is zero. The first test determines whether the matrix's rank Π is zero. Rank Π=0 is the null hypothesis, whereas rank Π=1 is the alternative hypothesis.

A likelihood ratio test is used to determine the largest Eigen value. The test statistic is

$$LR(r_0, r_{0+1}) = -T In(1-\lambda_{r0+1}) \quad \ldots\ldots\ldots\ldots (7)$$

The likelihood ratio test statistic LR (r_0, r_{0+1}) is used to determine if rank $(\Pi) = r_0$ vs the alternative hypothesis that rank $(\Pi) = r_{0+1}$. The likelihood ratio test statistic $LR(0,1) = -T In(1-\lambda_1)$ is used to test the hypothesis that ranks Π=0with the alternative hypothesis rank(Π)=1. The asymptotic x^2 distribution of this likelihood ratio statistic is not typical. The scenario is similar to that of the Dickey-Fuller test: the data's unit roots produce nonstandard asymptotic distributions.

3.3.4 Vector Error Correction Model (VECM)

The vector error correction model permits short-run changes while restricting the long-run behavior of the endogenous variables to their co-integrating connection. The term "error-correction" describes how the short-run dynamics of the dependent variable are impacted by the most recent phase of divergence from long-run equilibrium. By fitting co-integration between the variables, VECM has been carried out. Best (2008) argues that the limited capability of unit root testing can lead us to believe that our data is integrated when in fact it is not. We initially use the Johansen test of co-integration to make sure that all variables are I (1) before performing VECM. If they are not co-integrated, VECM is useless.

The VAR framework needs to be modified if the time series are not stationary in order to enable reliable relationship estimate. The vector error correction (VEC) model is only a particular case of the vector average

regression (VAR) for variables whose differences are stationary (i.e., I (1)). The VEC can also account for any co-integrating correlations among the variables. Consider the connected system equations for two time-series variables, yt and xt we found the model.

$$y_t = \beta_{10} + \beta_{11}\, y_{t-1} + \beta_{12}\, x_{t-1} + v^{y}_{t} \quad \ldots\ldots\ldots\ldots (8)$$

$$x_t = \beta_{20} + \beta_{21}\, y_{t-1} + \beta_{22}\, x_{t-1} + v^{x}_{t} \quad \ldots\ldots\ldots\ldots (9)$$

The equation expresses a system in which each variable's lag and the lag of the other variables in the system are functions of each other. The system in this scenario has two variables, y and x. The equations form a vector auto-regression system when they are combined (VAR). We have a VAR in this case since the greatest latency is of order one V (1). If y and x are steady, the system can be estimated by solving each equation with least squares. If y and x are not stationary in their levels but are stationary in their differences (i.e., I (1)), then estimate:

$$\Delta y_t = \beta_{10} + \beta_{11}\Delta y_{t-1} + \beta_{12}\Delta x_{t-1} + v^{\Delta y}_{t} \quad \ldots\ldots\ldots\ldots (10)$$

$$\Delta x_t = \beta_{20} + \beta_{21}\Delta y_{t-1} + \beta_{22}\Delta x_{t-1} + v^{\Delta x}_{t} \quad \ldots\ldots\ldots\ldots (11)$$

The system of equations is changed to allow for the co-integrating relationship between the I (1) variables if y and x are I(1) and co-integrated. The vector error correction (VEC) model is created by introducing the co-integrating connection.

3.3.5 Granger Causality Test

Suppose that Y and X are two variables that have the same data or observations over time. Before we can test for the fact that X doesn't Granger-cause Y, we have to pick the right p lagged values of Y the order of the AR(p) process. E-views do bivariate regressions in the following format:

$$y_t = \alpha_0 + \alpha_1.y_{t-1} + \alpha_2.y_{t-2} + \ldots.. + \alpha_p.y_{t-p} + \beta_1.x_{t-1} + \ldots.. + \beta_p.x_{t-p} + \varepsilon_t \quad \ldots\ldots\ldots\ldots (12)$$

Next, the Eq. (12) is augmented by including lagged values of the variable X:

$$x_t = \alpha_0 + \alpha_1.x_{t-1} + \alpha_2.x_{t-2} + \ldots.. + \alpha_p.x_{t-p} + \beta_1.y_{t-1} + \ldots.. + \beta_p.y_{t-p} + u_t \quad \ldots\ldots\ldots\ldots (13)$$

According to the null hypothesis, neither in the first regression nor in the second regression, x nor y are Granger-causing each other. It turns out that the t-statistic and F-statistic tests show that all lagged values of the variable X are statistically important. This means that the null hypothesis that variable X does not Granger-cause variable Y is accepted when no lagged values of the variable X remain after the t and F statistics are done in Eq. (13). It doesn't matter if we believe that variable X cause variable Y. We believe that variable X Granger-causes variable Y, which makes it more likely that variable Y's future values are dependent on variable X's current values.

4. Results and Discussion

4.1 Result of Unit Root Test

The results of Augmented Dickey Fuller (ADF) for a unit root test of migration, foreign remittance and economic growth variables are presented in the table.

Table 1. Augmented Dickey Fuller Unit Root Test

Variable	ADF test statistics	Critical Value			p-value	Stationary	Using
		1% level	5% level	10% level			
LGDP	3.091159	-3.596616	-2.933158	-2.604867	1.0000	NO	Level with intercept
D(LGDP1)	-4.763071	-3.600987	-2.935001	-2.605836	0.0004	YES	FD with intercept
LMIG	-1.790045	-3.596616	-2.933158	-2.604867	0.3802	NO	Level with intercept
D(LMIG1)	-6.283906	-3.610453	-2.938987	2.607932	0.0000	YES	FD with intercept
LFREM	-1.016812	-3.600987	-2.935001	-2.605836	0.7384	NO	Level with intercept
D(LFREM1)	-5.218058	-3.600987	-2.935001	-2.605836	0.0001	YES	FD with intercept
LGDP	-0.499413	-4.192337	-3.520787	-3.191277	0.9797	NO	Level with intercept & trend
D(LGDP1)	-6.052710	-4.198503	-3.523623	-3.192902	0.0001	YES	FD with intercept & Trend
LMIG	-3.971136	-4.192337	-3.520787	-3.191277	0.0174	NO	Level with intercept & trend
D(LMIG1)	-6.324730	-4.211868	-3.529758	-3.196411	0.0000	YES	FD with intercept & Trend
LFREM	-1.902702	-4.198503	-3.523623	-3.192902	0.6350	NO	Level with intercept &Trend
D(LFREM1)	-5.212320	-4.198503	-3.523623	-3.192902	0.0006	YES	FD with intercept & Trend

Table 1 represents the ADF test statistics. In the case of the dependent variable LGDP, the ADF test statistics of 3.091159 is less than critical values and the corresponding p-value is greater than 5%. That means the dependent variable LGDP is non-stationary at the level. But, after the first difference, the ADF test statistics - 4.763071 is greater than critical values and the corresponding p-value is less than 5%. That means the variable D(LGDP1) is converted from non-stationary to stationary after the first difference. But, after the first difference, the ADF test

statistics of all variables are greater than critical values, and the corresponding p-value is less than 5%. That means all the variables are non-stationary at the level and they are all converted from non-stationary to stationary after the first difference.

4.2 Results of Co-Integration Test

In order to apply this test, it is imperative to determine the optimal lag length and also the stability condition of the VAR. In the lag selection criteria, most of the researcher considered LR, FPE, AIC, SC, and HQ criterion. The result of this criterion is as follows.

Table 2. VAR Lag Order Selection Result

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-85.51128	NA	0.016772	4.425564	4.552230	4.471363
1	88.10553	312.5103	4.48e-06	-3.805276	-3.298612	-3.622083
2	92.91345	7.933076	5.57e-06	-3.595673	-2.709011	-3.275084
3	99.49872	9.877905	6.42e-06	-3.474936	-2.208276	-3.016952

In table 2 sign () show the optimal lag order that was suggested. It's mostly on the order 1. According to the rule, the best criterion with the lowest value is the SC at -3.298612. Now, we have to perform the Johansen Co-integration test to identify the long-run relationship between the variables. Johansen's test is a way to determine if three or more time series are co-integrated. It is based on the maximum likelihood method and gives two main statistics:

i. The Trace Test and
ii. The Maximum Eigen Value Test.

The Johansen Co-integration test result is expressed below in table-

Tables 4.3 and 4.4 present the results of the Johansen co-integration tests, specifically the Trace and Max-Eigen value tests, which indicate the presence of two co-integrating equations at the 0.05 significance level. This suggests that the variables are co-integrated, establishing a long-run equilibrium relationship among them.

In the Johansen co-integration test, the trace statistic exceeds the 5% critical value in the first line, leading to the rejection of the null hypothesis, which states that there is no co-integration at the 0.05 level. Specifically, the trace statistic (57.13866) is greater than the critical value (24.27596) with a p-value of 0.0000. This confirms the presence of at least one co-integrating equation. Similarly, at the second line (at most 1), the trace statistic (23.07668) also exceeds the 5% critical value (12.32090), with a p-value of 0.0006, further rejecting the null hypothesis of no co-integration. The outcome is in line with Saha (2025) and Akter *et al.*, (2024).

The Max-Eigen value test provides similar results. In the first line, the test rejects the null hypothesis of no co-integration at the 5% significance level, as the Max-Eigen statistic (34.06198) exceeds the critical value (17.79730) with a p-value of 0.0001. Additionally, in the second line (at most 1), the Max-Eigen statistic (21.70272) also surpasses the critical value (11.22480) with a p-value of 0.0005, again rejecting the null hypothesis. The results aligned with Saha (2025) and Saha (2023).

Therefore, based on both the Trace and Max-Eigen tests, there are two co-integrating equations among the three variables analyzed in this study. The presence of these co-integrating equations confirms a long-run equilibrium relationship between the variables, implying that they move together over time despite short-term fluctuations. To interpret the above normalized equation, we have to interpret it as inverse sign, such as: The coefficient of Migration (LMIG1) is (0.169397), meaning that there is a negative relationship between GDP and Migration. On the other hand, the coefficient of Foreign Remittance (LFREM1) is (-0.975052), meaning that there is a positive relationship between GDP and Foreign Remittance.

4.3 Result of Vector Error Correction Model (VECM)

If there are any co-integrating relationships between the variables, the Vector Error Correction Model (VECM), which is just one particular example of the VAR, can be applied. The vector error correction estimates are shown in below.

4.3.1 Result of Long-run Causality among Migration, Remittance and GDP

The existence of co-integration equation confirms that there is a long run relationship among MIG, GDP and FREM. This means that an error correction model exists which combines the long run relationship with the short run dynamics of the model. According to Engle and Granger (1987), the existence of co-integration implies that unidirectional or bidirectional Granger causality must exist. The long run Granger causality between the variables is given by the vector error correction term (VECT).

This error correction terms indicate the long-run equation and the signs of the long run relationship are actually the opposite of what are seen in error correction term. That means the value of Foreign Remittance (-1.192062) is negative and indicates that there is a positive long run relationship between GDP and Remittance. On the other hand, Migration (0.163836) indicates that there is a negative relationship between GDP and Migration in the long run.

Table 3. Short-run Coefficient with Speed of Adjustment

Error Correction	D(LGDP1)	D(LFREM1)	D(LMIG1)
CointEq1	-0.229610	0.658751	-0.181987
	(0.06781)	(0.13010)	(0.57174)
	[-3.38616]	[5.06338]	[-0.31830]
D(LGDP1(-1))	-0.266460	-0.347810	0.500630
	(0.13205)	(0.25337)	(1.11344)
	[-2.01782]	[-1.37276]	[0.44963]
D(LFREM1(-1))	-0.256023	0.140601	-0.813154
	(0.06940)	(0.13315)	(0.58514)
	[-3.68920]	[1.05595]	[-1.38967]
D(LMIG1(-1))	0.020389	-0.057056	-0.449135
	(0.02035)	(0.03904)	(0.17158)
	[1.00191]	[-1.46131]	[-2.61757]
C	0.004515	-0.012239	0.016595
	(0.00908)	(0.01741)	(0.07653)
	[0.49745]	[-0.70281]	[0.21684]

In above table 3, the coefficient of error-correction term (ECT) on first difference LGDP equation represents the proportion by which long run disequilibrium in the GDP can be corrected each year. The coefficient of error-correction term is -0.229610 which suggests that 22 percent of total disequilibrium in GDP is corrected in each year in Bangladesh. In other words, if model experiences shock in time period t, then it will converge back to the long-run equilibrium covering 22% in period t+1. This adjustment, although not rapid, is statistically significant which helps to attain equilibrium position or the steady-state position.

Dependent Variable: D(LGDP1)

Our estimated vector error correction model is-

D(LGDP1) = C(1)(LGDP1(-1) - 1.19206219727LREM1(-1) + 0.163836099398LMIG1(-1) + 0.0421911486836) + C(2)D(LGDP1(-1)) + C(3)D(LREM1(-1)) + C(4) D(LMIG1(-1)) + C(5)

Table 4. Summary Estimation of Vector Error Correction Model

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.229610	0.067808	-3.386160	0.0018
C(2)	-0.266460	0.132054	-2.017820	0.0513
C(3)	-0.256023	0.069398	-3.689196	0.0008
C(4)	0.020389	0.020350	1.001910	0.3233
C(5)	0.004515	0.009077	0.497447	0.6220

Estimated Equation

D(LGDP1) = - 0.229610(LGDP1(-1) - 1.19206219727LREM1(-1) + 0.163836099398LMIG1 (-1)+0.0421911486836)-0.266460D(LGDP1(-1))-0.256023D(LREM1(-1))+ 0.020389D(LMIG1(-1)) + 0.004515

From the error correction estimation table-4.8, we find the value of C (1) is -0.229610 and corresponding probability value (0.0018) is less than 5%. Since the value of C (1) is negative and significant, then we can say that there is long run causality from MIG, REM to GDP. The Error Correction term (ECT) for C (1) in GDP equation is correctly signed (negative) and statistically significant at 1% level of significance. It also suggests that there is a long-run causality among MIG, REM and GDP.

4.3.2 The Short-run Causality among GDP, Remittance and Migration

Table 5. VEC Granger Causality/Block Exogeneity Wald Tests

Dependent variable: D(LGDP1)			
Excluded	Chi-sq	df	Prob.
D(LREM1)	13.61017	1	0.0002
D(LMIG1)	1.003824	1	0.3164
All	14.03655	2	0.0009

Dependent variable: D(LREM1)			
Excluded	Chi-sq	df	Prob.
D(LGDP1)	1.884462	1	0.1698
D(LMIG1)	2.135438	1	0.1439
All	3.238999	2	0.1980
Dependent variable: D(LMIG1)			
Excluded	Chi-sq	df	Prob.
D(LGDP1)	0.202164	1	0.6530
D(LREM1)	1.931170	1	0.1646
All	2.378181	2	0.3045

From the above table 5, it is observed that in GDP equation, the null hypothesis of zero coefficient of LREM1 is rejected at 5% level of significance since the corresponding probability (p) value is less than 0.05. Therefore, the foreign remittance (FREM) Granger causes GDP growth in the short run. The short run causality validates the finding of long run causal relationship among the aforesaid macroeconomic variables. In REM equation, the null hypothesis of zero coefficients of GDP and Migration (MIG) cannot be rejected at 5% level of significance. This implies that GDP and Migration (MIG) do not, individually and jointly, Granger cause foreign Remittance (FREM) in the short run, since the corresponding p value is greater than 0.05. Similar result is found in case of Migration (MIG) equation i.e., the null hypothesis of zero coefficients of GDP and foreign Remittance (FREM) cannot be rejected at 5% level of significance. It indicates that GDP and foreign Remittance (FREM) do not, individually and jointly, Granger cause Migration(MIG) in the short run, since the corresponding p value is greater than 0.05.

As regards with the short run causal relationship between Remittance and other two variables, only Remittance is found to have short run causal effect on gross domestic product. The summary of the short run Granger causality is that there is a unidirectional causality running from Foreign Remittance (FREM) to GDP growth in Bangladesh. The existence of a short-term causal relationship between GDP and overseas remittances is very important for a small country like Bangladesh. This relationship has rational foundations. Remittances have the potential to boost the economy's productive potential by boosting foreign exchange reserves and providing funding for the purchase of capital goods and raw materials. Remittances raise the country's income by increasing aggregate demand. The fact that migrant remittances enable higher investments in health and education, which generate skilled labor and raise the economy's potential for productivity, is another way that they might boost income. Therefore, foreign remittance promotes GDP growth. The Wald test result does not provide any evidence of short run causality from Migration to GDP.

4.4 Result of Granger Causality Test

We apply the Granger causality test on GDP, MIG, and FREM to find out whether there is a causal relationship between them. The sample period spans from 1980 to 2022. According to Granger (1988), the Granger test can only be used if the variables are co-integrated yet stationary or non-stationary. We have demonstrated in our study that all variables (up to the first order difference) are non-stationary, but that they have a long-term co-integration relationship. Therefore, we can take the Pairwise Granger causality test and the result is in following table-

Table 6. Pair wise Granger Causality Tests

Null Hypothesis	Obs	F-Statistic	Prob.
LMIG1 does not Granger Cause LGDP1	40	0.66861	0.5188
LGDP1 does not Granger Cause LMIG1		0.02328	0.9770
LREM1 does not Granger Cause LGDP1	40	3.74513	0.0336
LGDP1 does not Granger Cause LREM1		0.09780	0.9071
LREM1 does not Granger Cause LMIG1	40	0.26351	0.7699
LMIG1 does not Granger Cause LREM1		0.28072	0.7569

From the conclusion of Granger causality test table 6, we can see that, in the first section, for the null hypothesis "LMIG1 does not Granger Cause LGDP1" the probability value of F-Statistic is greater than significance level (0.5188>0.05). Thus, we accept the hypothesis and believe that Migration does not Granger cause GDP. Similarly, for the null hypothesis "LGDP1 does not Granger Cause LMIG1" the probability value of F-Statistic is also greater than significance level (0.9770>0.05). Therefore, the hypothesis is accepted and GDP does not Granger cause Migration. This indicates no statistically significant between GDP and Migration.

In the second section of the table show that, for the null hypothesis "LREM1 does not Granger Cause LGDP1" the probability value of F-Statistic is less than significance level (0.0336<0.05). Thus, we reject the hypothesis and believe that Foreign Remittance does Granger cause GDP. On the other hand, for the null hypothesis "LGDP1 does not Granger Cause LFREM1" the probability value of F-Statistic is greater than significance level (0.9071>0.05). Therefore, the hypothesis is accepted and GDP does not Granger cause Remittance. This indicates there is one-way causality between Foreign Remittance and GDP. In the third section of the table, for the null hypothesis "LREM1 does not Granger Cause LMIG1" the probability value of F-Statistic is greater than significance level (0.7699>0.05). Therefore, the hypothesis is accepted and Foreign Remittance does not Granger cause Migration. Similarly, for the null hypothesis "LMIG1 does not Granger Cause LFREM1" the probability value of F-Statistic is also greater than significance level (0.7569>0.05). Therefore, the hypothesis is accepted and Migration does not Granger cause Foreign Remittance. This indicates no statistically significant between Migration and Foreign Remittance.

5. Conclusion and Policy Recommendations

This study explores the intricate relationship among migration, foreign remittances, and economic growth in Bangladesh, utilizing advanced time series econometric methods such as the Unit Root Test, Co-integration Test, and Granger Causality Test with the Vector Error Correction Model (VECM) over the period 1980–2022. The findings reveal that all variables exhibit stationarity at their first differences, indicating the need for further testing to establish long-run relationships. The Johansen Co-integration Test identifies two co-integrating equations, suggesting the existence of a long-run equilibrium relationship between foreign remittances and GDP. The normalized Johansen Co-integration equation indicates a positive relationship between GDP and foreign remittances, while migration shows a negative correlation with GDP, which could be attributed to the disruptions caused by the COVID-19 pandemic from 2019 to 2021, reflecting unusual trends in the data during this period.

The VECM estimates further support the existence of a long-term positive relationship between foreign remittances and GDP, indicating that remittances have consistently contributed to economic growth in Bangladesh. However, migration exhibits a long-term negative relationship with GDP, which may be reflective of the challenges posed by large-scale emigration without adequate return on human capital or domestic economic benefits during certain periods. In the short term, the VEC Granger Causality Test reveals that foreign remittances have a causal effect on GDP, suggesting that remittances are a crucial driver of short-term economic growth. However, migration does not exhibit a short-term causal relationship with GDP, and vice versa. Additionally, the results show no short-run causal relationship between migration and remittances, indicating that changes in one do not necessarily trigger changes in the other in the short term. Importantly, the study finds one-way causality between foreign remittances and GDP, where remittances Granger-cause GDP, but GDP does not Granger-cause remittances.

Based on these findings, several policy implications can be drawn to help promote sustainable GDP growth in Bangladesh. The following recommendations are proposed for policymakers:

1. Investment Policy for Remittances: The government should develop targeted investment policies to identify profitable sectors where migrant workers can invest their remittances. This would maximize the economic potential of remittances and channel them into productive sectors that contribute to long-term growth.

2. Labor Export Strategy: To boost remittance inflows from different countries, the government needs to craft a strategic plan for exporting labor. This should include negotiating labor agreements with host countries and diversifying the destinations for Bangladeshi workers.

3. Training and Awareness Programs: The government must enhance its training and skills development programs to increase the competency and motivation of workers before they migrate. Well-trained workers are more likely to secure higher-paying jobs, which would, in turn, increase the remittance inflow.

4. Alignment with National Development Strategies: The government's investment policies should align with Bangladesh's broader economic goals, such as the National Development Strategy Paper (NDSP) and the Poverty Reduction Strategy Paper (PRSP), ensuring that remittance-driven growth supports national development objectives.

5. Strengthening Bilateral Relations: Bangladesh should strengthen its bilateral relationships with key remittance-sending countries to ensure continued support for its migrant workers. Strong diplomatic ties can also facilitate the signing of more favorable labor agreements.

6. Legal Framework for Remittances and Migrant Workers: The government should enact and enforce laws and regulations that facilitate the smooth flow of remittances and protect the rights of migrant workers. Such legislation would provide a legal foundation for remittance transfers and ensure workers' rights are safeguarded.

7. Migrant Worker Welfare: Authorities must focus on protecting the rights of migrant workers, ensuring they are provided with a supportive environment throughout their journey—from preparation and departure to their return home.

8. Lowering the Cost of Remittance Transfers: The government should facilitate low-cost money transfer options to ensure that neither the sender nor the recipient incurs excessive fees. Lower transfer costs would encourage more formal remittance flows, benefitting both households and the national economy.

The study offers valuable insights that can guide the

formulation of targeted policies to maximize the benefits of remittances and labor migration for Bangladesh. As one of the top remittance-receiving countries globally, Bangladesh relies heavily on remittances for foreign exchange stability, poverty reduction, and household welfare improvement. An in-depth analysis of the role of remittances in Bangladesh's economy offers empirical findings to inform policies that enhance remittance flows, ensure sustainable economic growth, and improve the conditions of migrant workers. The following policy implications from this study can help Bangladesh strategically harness the potential of remittances to support broader socio-economic development.

A key implication of this study is the need for policies that improve the skill levels of Bangladesh's migrant workforce. Currently, most Bangladeshi migrant workers are employed in low-skill, low-wage jobs abroad, which limits their earning potential and, in turn, reduces remittance flows. To increase the earning potential of migrant workers, Bangladesh should invest in skill development programs that equip prospective migrants with technical and vocational skills relevant to high-demand jobs in host countries. Establishing partnerships with countries that demand skilled labor can further enhance job placement opportunities for Bangladeshi workers. This would lead to higher remittances, which contribute more significantly to economic growth and household income.

In addition to vocational training, the government could introduce a structured skill-certification system that meets international standards. Such certifications could enhance the employability of Bangladeshi workers in specialized roles and improve wage levels, ultimately increasing the volume and impact of remittances on Bangladesh's economy.

Another significant policy implication is the importance of encouraging the use of formal banking channels for remittance transfers. Remittances sent through formal channels contribute to foreign exchange reserves and improve financial sector stability. To support this shift, the government should expand incentives for remittance senders and recipients, including reducing transaction costs, offering tax benefits, and promoting digital remittance solutions. Low transaction fees for digital remittance platforms would incentivize the use of these channels, thus improving financial inclusion and liquidity in the banking sector.

Additionally, partnering with financial institutions and fintech companies can increase accessibility to formal remittance channels, especially in remote areas. Improving access to financial services, such as mobile banking and digital wallets, can help migrant families in rural areas receive remittances more conveniently. Increased usage of formal channels would help ensure that remittance flows are securely managed, better supporting Bangladesh's economic stability.

While remittances are a significant source of household income in Bangladesh, they are often spent on immediate consumption rather than long-term investments. To maximize the economic impact of remittances, policymakers could encourage recipients to channel a portion of their remittance income into productive investments such as small businesses, real estate, and education. Introducing incentives like matching grants or tax breaks for remittance recipients who invest in entrepreneurship or education could stimulate economic growth and job creation.

A dedicated investment fund for remittance recipients, managed through government-supported financial institutions, could provide loans for small businesses, housing, and other investments that contribute to local economic development. This approach could help turn remittances into a catalyst for long-term economic growth rather than just household income support.

The study highlights the importance of social protection policies for migrant workers, who often face challenging work conditions abroad. Many migrant workers face high recruitment fees, labor exploitation, limited access to health care, and social isolation. To address these challenges, the government can strengthen existing labor agreements with host countries to ensure fair wages, safe working conditions, and access to social services for Bangladeshi migrant workers.

Bangladesh can also establish support networks, such as overseas welfare desks and hotlines, to assist migrants with legal and social issues they may face abroad. For families of migrants, policies that provide financial literacy programs, health insurance, and emergency financial assistance can enhance the welfare of households dependent on remittances. Social protection measures for migrant workers ensure that remittances support not only economic growth but also the well-being of the workers and their families.

Bangladesh's heavy reliance on a few countries for remittances, particularly in the Middle East, makes it vulnerable to economic downturns, political instability, and policy changes in these host nations. Diversifying remittance sources by exploring new labor markets in regions like East Asia, Europe, and North America can mitigate these risks. Policies aimed at expanding the range of countries open to Bangladeshi migrant workers, along with targeted skill development for specific job markets, can help ensure a steady inflow of remittances.

In addition, bilateral agreements with a broader range of host countries can secure better conditions and protection for Bangladeshi workers, improving their ability to send remittances and contribute to economic growth. This diversification strategy reduces Bangladesh's economic vulnerability to changes in remittance flows from any single region, promoting long-term resilience in the country's economy.

Financial literacy among remittance recipients can enhance their ability to make informed financial decisions, encouraging them to save and invest remittance income effectively. Policies that support financial literacy programs can educate remittance-receiving households

on budgeting, savings, and investment options, increasing their ability to leverage remittance income for wealth creation.

Encouraging savings can also improve economic stability at the household level, reducing vulnerability to economic shocks. Financial literacy programs could be delivered through local community centers, online courses, or partnerships with NGOs. Additionally, promoting savings products such as pension schemes or insurance packages can offer remittance recipients financial security and resilience against unforeseen events.

Finally, the study highlights the importance of robust data collection and research on remittance flows, migration trends, and economic impacts. Effective policy-making requires accurate data on remittance contributions to household income, poverty reduction, and regional development. Investing in data collection systems and research institutions can provide reliable information for designing targeted policies that maximize the benefits of migration and remittances.

The government can collaborate with universities, international organizations, and research institutions to conduct longitudinal studies on the economic impact of remittances. Such data-driven insights would enable more informed decision-making, ensuring that policies are responsive to evolving migration trends, global economic shifts, and the changing needs of migrant families.

The policy implications of this study underscore the transformative potential of migration and remittances for Bangladesh's economic development. By optimizing labor migration, enhancing financial sector stability, encouraging productive investments, strengthening social protection, and diversifying remittance sources, Bangladesh can maximize the benefits of remittances. Additionally, financial literacy initiatives and data collection efforts can further support evidence-based policies that ensure sustainable economic growth, poverty reduction, and household welfare improvements. This study provides a roadmap for leveraging migration and remittances to secure a resilient, inclusive, and growth-oriented economy in Bangladesh.

By implementing these policies, the government can better harness the economic potential of migration and remittances to drive sustainable GDP growth, improve the livelihoods of migrant workers and their families, and contribute to broader national development.

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