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Determinants of Remittance in South Asian Countries during COVID-19

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Abstract: The COVID-19 pandemic disrupted global remittance inflows. This study analyzes remittance patterns from South Asia and key determinants like migrant stock, government incentives, and exchange rates using monthly data (2018–2022) and the Gravity Model. Results show a decline in total remittances, with growth in Bangladesh and Bhutan, declines in Afghanistan, the the Maldives, and Nepal, and stability in India, Pakistan, and Sri Lanka. Migration stock and exchange rates drive remittance flows, while government incentives matter only in Bangladesh. Findings suggest targeted policies, including skill-based migration, financial literacy, and lower remittance costs, to sustain remittances during crises.

Keywords: COVID-19; Exchange rate; Government incentive; Migration stock; Remittance flows; South Asia

1. Introduction

Remittances are one of the most important sources of external finance for South Asian countries, supporting millions of households in meeting basic needs, education, and health expenses. The COVID-19 pandemic created major disruptions to these flows by reducing migrant employment opportunities, restricting mobility, and slowing transfer channels. In 2020, remittance inflows to South Asia fell by about 3.6 percent, to USD 135 billion, as the global economy contracted¹). Yet the region showed strong resilience. By 2023, inflows had increased again to USD 186 billion, and forecasts suggest South Asia will record the fastest remittance growth among low- and middle-income regions in 2024, at nearly 11.8 percent²). At the country level, India remained the largest recipient with over USD 125 billion in 2023, while Bangladesh and Pakistan continued to rank among the top global recipients, receiving USD 22 billion and USD 27 billion, respectively³). The World Bank also reported in 2019 that global remittances had exceeded \$700 billion with \$550 billion for Low-and Middle-Income Countries (LMICs). More than one-fifth of that remittance had been received by South Asian nations, with India being the largest recipient securing \$83.3 billion⁴). These emerging economies consider remittance as their financial lifeline as it's the leading source of foreign currency and capital sources⁵). Accordingly, South Asian nations prioritize worker migration as a key economic determinant to curtail

unemployment and alleviate poverty⁶). In fact, the United Nations Sustainable Development Goals for 2030 is to “lower the cost of remittance transfer to 3%”⁷). The World Bank has also put forth collaborations between source and recipient countries to leverage remittance through diaspora bonds. However, with the outbreak of the COVID-19 pandemic, the resilience of remittance flows came into question reduced mobility for policies, businesses, and people created many obstacles for transferring money and influencing the means of subsistence for migrant laborers. These inadvertent consequences are particularly visible in developing countries. Global poverty is estimated to increase for the first time since 1990, with the poor concentrating in the Global South, particularly in South Asia⁸). It is important to evaluate the effects of COVID-19 on remittance in the developing world, particularly on the drivers of remittance in the wake of another disaster. In this study, we delve into the patterns and drivers of remittance to South Asia during the pandemic. We empirically analyze statistics from SAARC (South Asian Association for Regional Cooperation) and partner countries from January 2018 to December 2022. We use the Gravity Model, a replication of Newton's gravity model, to examine the gravitational drivers of remittance. This helps our study to focus on what policy makers are interested in: they want to make policies that stimulate remittance. Our study achieves its purpose by examining the aspects that impact remittance through gravitational factors. We also use Ordinary Least Squares (OLS), Poisson Pseudo-

Maximum Likelihood (PPML), Generalized Method of Moments (GMM), and Fixed Effects (FE) to assess the associations between the variables. To our knowledge, there is no research conducted across the SAARC nations that incorporates the Gravity Model. Research on remittance in the SAARC area has, for the most part, focused on macroeconomic variables and demographic factors. Such works also mainly focus on a small set of countries, mostly a single one, and not on the SAARC area as a whole. This knowledge gap is important to address because the SAARC nations are the biggest recipients of remittances, especially in times of crisis, for which clarifying the main aspects influencing remittance inflows is crucial. In fact, studies suggest that the gravity framework “can explain more than 50 percent of the variation in remittance flows across time and countries”⁹⁾. This makes the Gravity Model a powerful tool to explain remittance flows in the geographical area suggested in this study.

Our study contributes to the literature in many ways. Firstly, we provide insight into a vastly unknown topic: the remittance dynamics in South Asia during the pandemic. We find that COVID-19 reduced remittance due to its detrimental impact on the economic sustenance of migrant laborers. Secondly, our findings can help shift policy dialogue towards creating a sustainable remittance economy. We find suggestive evidence that migration stock, exchange rate, and government incentives are pivotal catalysts for remittances. Hence, in times of crisis, policy frameworks must be curated with those variables in mind. Thirdly, our results emphasize the necessity to further investigate the impact of government incentives on remittances in South Asia, emphasizing the significance of a nuanced comprehension of the distinct socioeconomic circumstances of each nation. We observe that although incentives have a notable impact on remittance patterns, there are discrepancies among different nations. This also further highlights the need for customized initiatives during times of crisis for South Asia that rely on remittances for economic stability and advancement.

The rest of the paper is organized as follows. In section 2, we examine empirical literature to determine the macroeconomic determinants of remittance. We then summarize the theoretical framework of the Gravity Model in Section 3 to explain how we adapted the standard model to use macroeconomic variables in our study. Section 4 presents the data and the variables of the study. Section 5 discusses the results, while Section 6 outlines the directions for policymakers with some concluding remarks.

2. Literature Review

In this section, we summarize selected empirical literature on the macroeconomic determinants, mainly focusing on the motives behind remittance. It is further subdivided into

three parts: motives behind South Asian remittance, impact of COVID-19 shocks, and the Gravity model approach found in previous literature.

2.1. Motives behind South Asian remittance

Remittances in South Asia serve as an important financial lifeline for countless families, driven by a range of motivations. These remittances are influenced by a variety of factors and causes. The primary objective of South Asian migrants is to send remittances in order to provide essential support to their families, which includes fulfilling vital requirements such as sustenance, education, and healthcare. Moreover, it is notable that this money frequently goes into projects that generate revenue, thus perhaps stimulating economic growth within the respective area. Certain remittances are designated for the goal of repaying debts or loans that were incurred for migration or other reasons. In contrast, other remittances are wisely set aside as savings to ensure future financial stability, which may be used for unforeseen circumstances, weddings, or the purchase of property. The numerous motivations behind the diversified and vital function of remittances in South Asian families and economies are evident.

In this review, we divide our assessment into three distinct categories. The introductory section focuses on the identification of motives that influence remittances in the South Asian context. The second section addresses the influence of the COVID-19 on remittance flows within the South Asian area but in only limited scale. The final section of this review section focuses on identifying areas of research that have not been well addressed. Specifically, it examines existing literature that has used the Gravity model to evaluate the impact of the COVID-19 pandemic on remittances in South Asia.

2.2. Economic, Demographic, and Policy Factors

Altruism, which is based on compassion and a sincere inclination to assist others, emerges as the main motivating factor behind remittances. This phenomenon provides significant understanding into the potential for selflessness and the complex dynamics of foreign financial assistance. The altruistic incentive becomes particularly evident when examining the motivations of the South Asian immigrants, which signifies the deep emotional connections that link migrants to their places of origin, family, and communities. The phenomenon extends beyond just economic self-interest, emphasizing the deep feeling of duty and concern that migrants have towards their family members residing in their country of origin. The complex socioeconomic conditions prevalent in the South Asian sub-region provide a fertile ground for the development of altruistic behavior. When confronted with economic challenges and misfortune, persons who have undergone migration may have an increased sense of moral responsibility to provide

assistance to their family and communities. The impetus behind this goal is not only rooted in monetary acquisition but also stems from the desire to elevate others who may be more susceptible to economic adversities.

Upon further investigation of the prevalence of altruism within the framework of remittances, it becomes apparent that this inclination is a fundamental and culturally important element of South Asian communities. Remittances have a crucial role in supporting the financial stability and development of many families, so boosting their economic well-being and resilience within the South Asian area.

Using the gravity model to analyze remittance behavior in a particular study with a focus on South Asia. The findings of the research emphasize the significant role of altruism as a key determinant of remittances in this region. The study provides a thorough analysis of economic indicators, including variables such as the discrepancy in output, foreign currency exchange rates, per capita gross domestic product, and the number of migrants. This research is of significant importance because of its comprehensive incorporation of many economic factors, such as consumer prices, unemployment rates, loan accessibility within the banking system, labor trade agreements between nations, and the influence of the destination country's status as an oil exporter on migrant populations. These supplementary aspects contribute to a thorough comprehension of the economic dynamics that impact remittances¹⁰. One significant discovery derived from this research is the existence of a positive association between remittances and inflation, suggesting that a rise of one percent in domestic inflation is linked to a corresponding increase of 0.29 percent in remittance inflow. Moreover, their study demonstrates the correlation between remittances and the gross domestic product (GDP) of host countries, including the United Kingdom, Saudi Arabia, Malaysia, Kuwait, and the United Arab Emirates. A notable increase of 1.95 percent in remittance inflows to South Asia is seen for each 1 percent improvement in the GDP of the host country. Significantly, this analysis demonstrates that migration and exchange rates, albeit exerting influence, do not possess statistical significance within this particular setting. A further study into the factors influencing remittances among the South Asian population residing in Manchester serves to reinforce the prominence of altruistic incentives as driving forces behind such financial transfers. While the scope of this research was limited to a particular diaspora, it offers significant insights into the wider context of South Asian remittances. The study investigates the many determinants that impact the remittance behavior within this particular group, with a particular focus on the significant influence of compassion as a primary driver for individuals to transfer money to their countries of origin. The cumulative results from this research highlight the significant importance of compassion in encouraging

remittances in South Asia. Despite the presence of difficult macroeconomic conditions in the area, it is evident that the diaspora is mostly motivated by an inherent inclination to provide assistance to their relatives and communities, rather than pursuing personal gain. The aforementioned findings have significant value for policymakers and scholars who want to understand and tackle the intricate nature of remittance behavior within the South Asian context. These insights may aid in the development of well-designed policies that effectively support this crucial financial lifeline for the area^{11,12}.

2.3. Rational economic profit motive

The economic factors in the context of remittances involve several financial aspects, including but not limited to income levels, job prospects, economic stability, income volatility, and economic inequalities between the host nation (where migrants are employed) and the home country (from which migrants originate). Various variables impact the choice of migrants to engage in remittance activities, with income differences often serving as a key motivator for such financial transfers. This is particularly evident when migrants are able to provide economic assistance to their family members residing in areas characterized by lower income levels. Conversely, demographic considerations include the characteristics and arrangement of the population in both the host and home nations. Important demographic determinants include the composition of age groups that rely on others for support, the magnitude of the population, the ratios of dependents to working-age individuals, as well as the influence of natural disasters, educational achievements, and the proficiency levels of migrants. Demographic considerations have a significant role in shaping remittance behavior, as seen by the correlation between certain parameters and the magnitude of remittance flows. Specifically, a greater number of younger dependents, bigger populations, and higher dependence ratios tend to be associated with increasing remittance flows. Comprehending the intricate relationship between economic and demographic variables is of utmost importance for policymakers and scholars who want to develop effective strategies and policies that promote remittances and harness their beneficial effects on the economies of both host and home countries.

Research focusing on the South Asian community in Qatar, Manchester, provides insights into the influence of economic and demographic factors on remittances in South Asia. The research conducted emphasizes the significant influence of income levels in both the receiving and sending countries as a key factor in driving the transfer of remittances. One significant finding of their study is that the presence of a younger dependent population in the home nation tends to result in an increase in remittance flows. This finding implies that migrants have a greater

propensity to engage in remittance activities when their families have a larger percentage of dependents, hence demonstrating a heightened feeling of obligation in meeting their families' economic need. Furthermore, the research results indicate that there is a potential increase in remittances after natural disasters, which might be attributed to the migrants' inclination to provide support to their communities of origin during times of emergency.

The significance of income levels in both the host and home countries as a driving force behind remittances is affirmed. One intriguing discovery indicates that the likelihood of remittances increasing is higher in instances when there is heightened economic uncertainty among the migrant community. This observation underscores the significance of economic risk and the migrants' inclination to use remittances as a strategy for alleviating financial worries.

There is a positive correlation between remittances and many parameters, such as the increase in per capita GDP in the sender's country, higher levels of education, greater migration rates, increased trade openness, political stability, and wage growth in the recipient countries. This highlights the significance of economic welfare and prospects as drivers for remittance transactions.

In a nutshell, these studies together underscore the complex interplay between the economic and the demographic variables and the patterns of remittance behavior in the South Asian region. Several factors contribute to the motivation for remittances, including the welfare of both the host and the home nations, the age distribution of the dependent population, and the presence of economic possibilities¹³⁻¹⁴.

2.4. Investment motive

The investment motive, within the framework of remittances, refers to the preference of individuals to allocate a portion of their remittance funds towards investments in assets, enterprises, or other ventures that generate income, with the objective of attaining financial growth, stability, and potential long-term gains. In contrast to remittances that are primarily directed towards immediate consumption or familial assistance, the investment motivation entails a strategic strategy wherein remittances are used to generate wealth, foster economic growth, or mitigate risk by capitalizing on possibilities inside the domestic economy.

Analyzing the determinants of international remittance inflows in middle-income countries in Asia and the Pacific, which includes South Asian nations, some study finds the positive associations between remittances and several factors in the host country, emphasizing the multifaceted nature of remittance motivations. Research has shown a positive relationship between the rise of per capita GDP in the nation of origin. This observation implies that an enhancement in the economic prosperity of the recipient

nation might result in a rise in the number of remittances received. There exists a positive correlation between educational attainment and remittances, suggesting that individuals with higher levels of education are more likely to remit larger amounts. Additionally, the volume of migration has a notable impact, as countries with higher migrant populations tend to receive greater inflows of remittances. The effect of remittance flows is influenced by factors such as trade openness, political stability, and wage growth in the receiving nations. These factors highlight the importance of economic and political circumstances in the host country.

Another study was conducted to examine the macroeconomic factors that influence international bilateral remittance flows, using a gravity model methodology. The results of their study are consistent with the notion that there are positive connections between remittances and different elements in the host nation. This further reinforces the notion that the circumstances in the host country play a role in motivating individuals to send remittances.

This research examines the macroeconomic factors that influence remittance flows to India, providing valuable insights into the underlying drivers of remittance behavior. The study conducted by the authors is expected to provide a valuable contribution to the existing body of knowledge on the many elements inside the host country that have an impact on remittance behavior.

The collective significance of host country variables in stimulating remittances in South Asia. There exists a positive correlation between remittances and several factors including the increase in per capita GDP, educational achievement, volume of migration, level of trade openness, political stability, and wage growth within the receiving nation¹⁵⁻¹⁷.

But another group has argued that several factors can negatively impact remittance inflows in South Asian nations. These factors include the official currency rate of the home country and the political stability index of the home nation. Other aspects, such as the quantity of migrants residing in the host country, home country population size, transaction costs, and social, political, and cultural connections, also affect remittances^{18,19}.

2.5. Mitigating financial risks motive

The mitigating financial risks motive, in the context of remittances, refers to the intention of individuals to use a portion of their remittance funds as a financial safety net to address and alleviate economic uncertainties and risks. Instead of solely directing remittances toward consumption or daily expenses, individuals employing this motive strategically allocate remittances to build a financial cushion that can be accessed during times of income instability or unforeseen challenges, aiming to provide stability and security for themselves and their

families. This motive reflects a proactive and risk management approach, using remittances as a means to mitigate the impact of financial uncertainties and maintain economic resilience. In the context of South Asian remittances, the motivation to mitigate financial risks becomes prominent, as some people strategically use remittances to actively address economic uncertainty. The observed behavior exhibits variability contingent upon individual attributes, including age, educational attainment, and household size, since it functions as a means of financial security for those experiencing fluctuations in income. In addition, the existence of entrepreneurial and economically dynamic communities has a favorable impact on the transfer of remittances. In such communities, individuals receiving remittances have the opportunity to use this money towards income-generating endeavors or entrepreneurial ventures, so as to augment their financial stability and ability to withstand economic challenges. Based on a group of studies, it becomes evident that remittances are not solely driven by altruism or economic factors. Some individuals within the South Asian diaspora employ remittances as a financial strategy to mitigate income uncertainty and manage risks. This behavior can be influenced by personal characteristics, such as age, education, and family size. Additionally, the presence of entrepreneurial and economically vibrant communities has a positive impact on the flow of remittances, as it may provide opportunities for investment and risk management²⁰⁻²²).

2.6. South Asian remittance during Covid 19 pandemic

Remittance flows to South Asia increased by over 12 percent in 2022 to reach \$176 billion stemming from robust labor market conditions in the high-income OECD destination economies of the region, a high demand for less-skilled migrants in GCC countries, and policies to counter food price inflation that supported migrant incomes in GCC countries. With inflows exceeding \$111 billion in 2022 a growth rate of more than 24 percent India continued to be the greatest receiver globally. Other regional participants with worldwide ranks were Bangladesh (ranked seventh) and Pakistan (ranked fifth), with remittance inflows of \$22 billion and \$30 billion, respectively, in 2022. Nepal is in the ninth place among the nations whose remittance inflows account for a significant portion of GDP, with remittances making about 23% of GDP. Remittances have grown in significance as a source of outside funding in the post-COVID era. Their resilience has been shown. Remittances to low- and middle-income nations reached \$647 billion in 2022, up 8% from the previous year and above our six-month projections. This gain is noteworthy since it came after a growth rate of 10.6 percent in 2021, during when the global economy was weakening, there was inflation. In addition, the COVID-19

pandemic has caused supply chain disruptions worldwide, decreased consumer spending, job losses, and firm closures. As the virus traveled from China to Europe and the US, markets saw a sharp dip and heightened volatility. This has all had an adverse effect on people's and organizations' financial security.

However, due to the decreasing economic development in the main source nations, it is anticipated that remittance growth will drop to 1.4 percent in 2023, reaching a Figure of \$656 billion. All areas should see slower remittance growth, with Europe and South Asia (1 percent) and South Asia (0.3 percent) seeing the most reduction.

Remittance growth to South Asia is predicted to decline to 0.3 percent in 2023 as a result of the OECD nations' economies contracting, particularly the US high-tech industry, which impacts the need for IT employees. Over 60% of the region's remittances go to India, and growth in this amount is predicted to be only 0.2% in 2023. The demand for migrants in the GCC countries, where falling oil prices are predicted to slow the growth from 5.3 percent in 2022 to 3 percent in 2023, as well as the ongoing diversion of formal remittances toward informal money transfer channels due to worsening domestic economic conditions, will also limit remittance flows to the other six South Asian countries^{10),23-25}).

2.7. South Asian remittance: Gravity model approach

Analyzing remittances and the variables that affect them is crucial in the subject of international economics, particularly when considering South Asian nations. These countries' economy depends heavily on remittances, which support their stability and growth. This comparative study focuses on three distinct studies that investigate the factors influencing remittance inflows to South Asian nations using a gravity model technique. Each study clarifies the several elements influencing the remittance flows, adding to our overall comprehension of this intricate issue. A gravity model approach to the analysis of remittances reveals numerous important factors that influence remittance inflows. It is discovered that the quantity of remittances received is highly influenced by the production gap, foreign exchange rates, GDP per capita, and the migrant stock. These results point to the economic variables influencing remittance flows to Bangladesh. Interestingly, the research also takes into account other economic aspects such consumer prices, unemployment rates, banking system credit availability, bilateral labor trade agreements, and the destination country's role as an oil exporter for migrants. These elements provide a more thorough picture of the variables affecting remittances to Bangladesh. A noteworthy finding indicates a positive correlation between remittances and inflation: a one percent rise in domestic inflation corresponds to a 0.29 percent increase in remittance inflow. The research also

shows that remittances to Bangladesh are quite sensitive to the GDP of a number of host nations, such as the UK, Saudi Arabia, Malaysia, Kuwait, and the United Arab Emirates. Remittance inflows rise by a significant 1.95 percent for every 1% growth in the GDP of these host nations. Despite estimates of 0.08 and 0.02 for the remittance elasticity with respect to migration and exchange rate, respectively, neither variable is statistically significant in this setting. In order to determine the variables driving remittance flows, the third research adopts a gravity model technique. Remittances are significantly impacted by the degree of political and financial stability in South Asia, the size of the migrant population in the receiving nation, and better economic circumstances in this region. Focusing more on South Asian nations, another gravity model is used to comprehend the factors that influence remittance flows. In addition to economic variables, this research takes risk-related and demographic factors into account in both the home and the host nations. One important conclusion is that higher remittances are often drawn from countries where there is a greater number of dependents and more susceptibility to natural disasters. This suggests that the provision of disaster assistance and support to families is an important driver of remittances in this area. On the other hand, remittances tend to decrease with political stability in the home country, indicating that migrants prefer to remit more when confronted with political uncertainty back home. Moreover, remittances are positively correlated with political risk in the host nations, suggesting that migrants send more money home when the hazards in their new country are greater.

In summary, these three gravity model-based studies provide insightful information on the factors influencing remittances in South Asian nations. They underline the significance of having a detailed knowledge of remittances in each unique environment and draw attention to the wide variety of factors influencing remittance inflows, from economic variables to demographic and political issues²⁶⁻²⁹.

As per our findings, no paper has yet analyzed the impact of COVID-19 on remittance inflow using the Gravity model in the context of South Asia. This provides insight into the remittance dynamics in South Asia during the COVID-19 pandemic.

3. The econometric model

The gravity model in the discipline of economics was used as a means of explaining the flow of trade between two countries³⁰. Later on, the gravity model was applied widely to describe a variety of additional macroeconomic variables like foreign direct investment³¹, tourist revenues³², cross-border migration³³ etc., amongst other factors.

Our empirical model of remittance inflow was constructed with the use of the Gravity framework and was based on the method that was suggested³⁴⁻³⁸. The fundamental paradigm for remittances between two nations, denoted by "i" (home country) and "j" (partner country) is as follows:

$$Rem_{ijt} = \frac{\beta_0 GDP_{it}^{\beta_1} GDP_{jt}^{\beta_2}}{Distance_{ij}^{\beta_3}} \varepsilon_{ijt} \quad (1)$$

The model assumes remittance flow is directly proportional to home and partner countries' GDP and inversely proportional to Distance. Taking the natural log on both sides, equation (1) can be rewritten as:

$$\ln Rem_{ijt} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln Distance_{ij} + \varepsilon_{ijt} \quad (2)$$

Here, Rem_{ijt} = Remittance flow to home country i from country j at time t, GDP_{it} = GDP of country i (home country at time t, GDP_{jt} = GDP of country j (partner country) at time t, $Distance_{ij}$ = Distance between country i and j and ε_{ijt} is the random error term.

Since our paper deals with remittance inflow to South Asian Countries (home countries) from their partner countries, we can incorporate "i=1, 2...8" in the equation. The model can be further extended using a set of suitable control variables X_{ijt} .

$$\ln Rem_{ijt} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln Distance_{ij} + \phi X_{ijt} + \varepsilon_{ijt} \quad (3)$$

To extend the Gravity model of remittance inflow, first, we take a standard set of gravity control variables like population, contiguity, common language, and shared colonial history from the dynamic Gravity dataset (Gravity Portal: Dynamic Gravity Dataset (2019)).

In addition to that, the migration stock is included in the model as a control variable. The number of people who migrate and the amount of money that they send home are strongly correlated. The amount of money that migrant workers can send back to their home countries increases as the number of opportunities for them to work in other nations increases^{34,38}. Within the framework of the approach, we additionally include an incentive for remittance. A complicated part of the remittance flow is also played by the currency rate between the two countries. A weakening of the currency used domestically in the sender's nation results in an increase in the amount's ability to buy goods and services. Migrant workers may be encouraged to send more money back home to their families as a result of the depreciation of the native currency, which increases the value of the foreign currency. Since our primary aim is to determine the effect of COVID-19 on the amount of money sent back home, our first step is to include a COVID-19 dummy in the Gravity

model. The COVID-19 dummy variable is assumed to have a value of 0 for periods that occur before the COVID-19 breakout, and it is assumed to have a value of 1 for periods that occur after the COVID-19 breakout. In addition to this, we also performed estimations using the following explanatory variables: the number of COVID cases, the number of COVID deaths, and the rollout of vaccinations in both the home country and partner countries. The extended linear models can be written as:

$$\ln Rem_{ijt} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln Distance_{ij} + \beta_4 \ln MigS_{ijt} + \beta_5 BERI_{ijt} + \beta_6 Incentive_{it} + \beta_7 Covid_t + \beta_8 CovidCases_{it} + \beta_9 CovidCases_{jt} + \phi X_{ijt} + \eta_{ijt} \quad (4)$$

$$\ln Rem_{ijt} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln Distance_{ij} + \beta_4 \ln MigS_{ijt} + \beta_5 BERI_{ijt} + \beta_6 Incentive_{it} + \beta_7 Covid_t + \beta_8 CovidMortality_{it} + \beta_9 CovidMortality_{jt} + \phi X_{ijt} + \eta_{ijt} \quad (5)$$

$$\ln Rem_{ijt} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln Distance_{ij} + \beta_4 \ln MigS_{ijt} + \beta_5 BERI_{ijt} + \beta_6 Incentive_{it} + \beta_7 Covid_t + \beta_8 CovidVaccination_{it} + \beta_9 CovidVaccination_{jt} + \phi X_{ijt} + \eta_{ijt} \quad (6)$$

In the past, FE- and RE-based approaches have been frequently employed to experimentally estimate the Poisson Count Gravity model. However, FE approaches are unable to quantify the influence of characteristics that do not change over time. This includes variables such as the distance between nations, the beginning of colonial rule, contiguity, shared language, and so on. Estimates based on RE may include time-invariant variables; however, when heteroskedasticity, multicollinearity, and autocorrelation are present, these estimates become untrustworthy. Poisson Count OLS gravity estimates are more prone to the issue of multicollinearity than standard gravity models because gravity models use several dummy variables, each of which can only take on the value of 0 or 1.

The Poisson Pseudo Maximum Likelihood (PPML) approach is more suited for estimating the Gravity model because it accounts for heteroscedasticity and zero values in the dataset and is a non-linear estimator³⁹. This makes it more suitable for the estimation of the Gravity model. They demonstrated, with the use of the Monte Carlo estimate, that the PPML approach yields more accurate estimates than the OLS technique does, even when the dependent variable has random occurrences of zero values. The framework known as the Generalized Linear Model (GLM) contains the PPML estimator as a particular instance. Estimating constant elasticity may be done using PPML by assuming a proportionate link between the variance and the means.

It utilizes an exponential function instead of a linear function, and therefore, equations (4), (5), and (6) are now

transformed into the following exponential format:

$$Rem_{ijt} = \exp(\beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln Distance_{ij} + \beta_4 \ln MigS_{ijt} + \beta_5 BERI_{ijt} + \beta_6 Incentive_{it} + \beta_7 Covid_t + \beta_8 CovidCases_{it} + \beta_9 CovidCases_{jt} + \phi X_{ijt}) \eta_{ijt} \quad (7)$$

$$Rem_{ijt} = \exp(\beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln Distance_{ij} + \beta_4 \ln MigS_{ijt} + \beta_5 BERI_{ijt} + \beta_6 Incentive_{it} + \beta_7 Covid_t + \beta_8 CovidMortality_{it} + \beta_9 CovidMortality_{jt} + \phi X_{ijt}) \eta_{ijt} \quad (8)$$

$$Rem_{ijt} = \exp(\beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln Distance_{ij} + \beta_4 \ln MigS_{ijt} + \beta_5 BERI_{ijt} + \beta_6 Incentive_{it} + \beta_7 Covid_t + \beta_8 CovidVaccination_{it} + \beta_9 CovidVaccination_{jt} + \phi X_{ijt}) \eta_{ijt} \quad (9)$$

Our dataset consists of monthly remittance inflows to eight South Asian countries from their respective partner countries, forming a panel dataset with observations over time. While PPML is an appropriate estimator for count data models with heteroskedasticity and zero-inflated values, a key concern is the presence of time-invariant unobserved heterogeneity across countries. In traditional gravity models, trade economists often employ panel data techniques, particularly Fixed Effects (FE) and Random Effects (RE) models, to address country-specific heterogeneity according to Anderson & van Wincoop, in 2003. To ensure robustness, we extend our empirical analysis by incorporating FE and RE panel models, enabling us to control for unobservable time-invariant characteristics of each country that may influence remittance flows.

The Fixed Effects (FE) model controls for time-invariant country-specific factors (e.g., structural economic characteristics, governance quality, historical remittance patterns) by differencing out country-level heterogeneity. The equation for our FE model is:

$$\ln Rem_{ijt} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln Distance_{ij} + \beta_4 \ln MigS_{ijt} + \beta_5 BERI_{ijt} + \beta_6 Incentive_{it} + \alpha_i + \gamma_j + \varepsilon_{ijt} \quad (10)$$

where:

α_i captures country-specific fixed effects,

γ_j controls for time effects (monthly dummies to account for seasonality and global shocks),

ε_{ijt} is the error term.

The Random Effects (RE) model, in contrast, assumes that country-specific effects are uncorrelated with the regressors and can be specified as:

$$\ln Rem_{ijt} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln Distance_{ij} + \beta_4 \ln MigS_{ijt} + \beta_5 BERI_{ijt} + \beta_6 Incentive_{it} + u_i + \gamma_j + \varepsilon_{ijt} \quad (11)$$

u_i represents random country-specific components.

To determine the appropriate panel model, we conduct a Hausman test (Hausman, 1978). The test evaluates whether the individual effects in the FE model are correlated with the regressors. If the p-value of the Hausman test is below 0.05, we reject the RE model and adopt the FE model.

4. Data and variables

Monthly data on remittance inflow to South Asian Countries (Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka) from their partner countries are collected from January 2018 to December 2022 from the Central Bank database. As an alternative to monthly GDP data, monthly Industrial Production Index (IPI) data is used instead as a proxy for GDP. This is because monthly GDP data is not available. While the IPI is used as a proxy for GDP to enable the use of monthly data, it should be noted that the COVID-19 pandemic had a more pronounced impact on the manufacturing sector than on the services sector, where remote work was more feasible. This could lead to an overestimation of the effects of economic activity in partner countries during the pandemic. However, the inclusion of fixed effects mitigates some concerns by accounting for time-invariant productive characteristics of the partner countries. Monthly IPI data was collected from International Financial Statistics by the International Monetary Fund (IMF) for South Asian countries and partner countries (Singapore, Malaysia, Japan, Italy, and the UK). Libya and Middle Eastern nations, however, don't have monthly IPI statistics. Since the economies of those countries are heavily dependent on oil production, we created the Oil Production Index as a proxy of GDP. World Bank and EIA monthly crude oil price and production data are used to calculate Oil Production Index.

Distance and standard gravity control variables like population, contiguity, and common language are taken from the Dynamic Gravity datasets constructed by the United States International Trade Commission. Where, the "landlocked" variable accounts for countries that lack direct access to sea routes. Such geographic constraints can exacerbate logistical challenges for migration and the transmission of remittances. During the COVID-19 pandemic, the restricted cross-border mobility and disruptions in transportation networks likely posed additional barriers for migrants from landlocked countries. By including this variable, we aim to capture the potential impact of these unique constraints on remittance flows.

The "island" variable captures the dynamics specific to island nations, where remittance flows are heavily reliant on air or sea routes. The COVID-19 pandemic significantly disrupted global transportation, leading to challenges in both migration and remittance transmission for island

countries. This variable helps us explore whether these disruptions disproportionately affected remittance flows from or to island nations. Migration stock data is collected from the Bureau of Manpower Employment and Training (BMET) and the International Organization of Migration (IOM). We collect exchange rate data from the Central Bank dataset. To tackle the issue of different currency units, a Bilateral Exchange Rate Index (BERI) is constructed, where the exchange rate of each month for each country is divided by the exchange rate of the base year of that particular country. Furthermore, COVID cases, COVID Mortality, and COVID Vaccination data are collected from the Our World in Data website. Migrant stock is included as a control variable because the number of migrants abroad directly determines the capacity to send remittances, and prior studies have consistently shown a strong positive link between migrant stock and remittance inflows^{34,38}. Similarly, the exchange rate is an important factor since fluctuations in currency values shape the purchasing power of remittances and influence the decision to remit through formal channels; empirical evidence confirms that such variations significantly affect remittance behavior across developing economies^{35,37}. Although Bangladesh is the only South Asian country to have introduced a direct cash incentive for remittances during the COVID-19 period, this policy factor is retained in the model to capture the institutional dimension of remittance flows, while recognizing that its strongest effect is specific to the Bangladeshi context.

5. Results and discussions

The following table shows variable definitions and sources of data used in this paper. Variables are represented in the first column of Table 1, and the definitions of the variables are in the second column. The next two columns represent sources of data used for this paper and expected signs of the parameters. Standard errors are clustered at the destination-partner country level to account for within-group correlation in Tables 4 and 7.

The dynamics of remittance flows in South Asia cannot be understood as a uniform regional trend, since the role of remittances varies widely across countries. Within India, for example, the state-level origins of migration strongly shape remittance inflows. Kerala has historically been the largest source of Indian migrants to the Gulf, generating substantial remittances due to its strong diaspora networks and reliance on overseas employment. In contrast, states such as Gujarat and Punjab send migrants with more diversified occupational profiles and longer migration histories. The Indian diaspora often represents a second- or third-generation community, which explains why remittances from India tend to be stable but relatively modest in per capita terms compared to countries where migration is more recent^{34,38}. Pakistan and Nepal stand in

Table 1: Variable definition and sources of data

Variables	Definitions	Sources of data	Expected sign of the parameters
Remittance	Remittance inflow from partner countries of South Asia	KNOMAD (2022) retrieved from: https://www.knomad.org/data/remittances	+
Industrial Production Index (IPI)	The industrial production index (IPI) is a monthly economic indicator measuring real output in the manufacturing, mining, electric, and gas industries relative to a base year	International Monetary Fund (2022) retrieved from: https://data.imf.org/regular.aspx?key=61013712	+
Migration stock	Migrant people from South Asian country to partner countries	BMET (2022) retrieved from: http://www.old.bmet.gov.bd/BMET/statisticalDataAction KNOMAD (2022) Retrieved from: https://www.knomad.org/data/migration/emigration	+
Exchange rate	Exchange rate of South Asia currency and partner countries' currencies	Asian Development Bank (2022)	+
Incentive	Incentive to formal channel remittance sender	Bangladesh Bank (2022) Asian Development Bank (2022)	+
Distance	Geographical distance between home and partner countries	USITC retrieved from: https://www.usitc.gov/data/gravity/dgd.htm	-
Common language	It is a dummy variable. If both home and partner countries have a common official language, then the dummy=1, otherwise 0	USITC retrieved from: https://www.usitc.gov/data/gravity/dgd.htm	+
Contiguity	It is a dummy variable. If home and partner countries share a common land border, the dummy is=1, otherwise 0	USITC retrieved from: https://www.usitc.gov/data/gravity/dgd.htm	+
Island	It is a dummy variable. If a country is surrounded by water, then the dummy is=1; otherwise, 0 for home and partner countries	USITC retrieved from: https://www.usitc.gov/data/gravity/dgd.htm	-
Landlock	Landlock is a dummy that indicates a country is almost or completely surrounded by land if a country is landlocked, the dummy is=1, otherwise 0 for home and partner countries	USITC retrieved from: https://www.usitc.gov/data/gravity/dgd.htm	-
Covid dummy	For covid period (2020M1-2022M12), the value is=1; for 2018M1 to 2019M12, it is 0		-
Covid cases	Total cumulative monthly confirmed cases per million per month	Mathieu retrieved from https://ourworldindata.org/coronavirus	-
Covid mortality	Total cumulative monthly confirmed deaths per million per month	Mathieu retrieved from https://ourworldindata.org/coronavirus	-
Covid vaccinations	Total cumulative number of people who vaccinated for covid each month in home and partner countries	Mathieu retrieved from https://ourworldindata.org/coronavirus	+

Source: Authors' compilation based on data sources in the Table 1.

Table 2: Yearly (2018-2022) received Remittance (million USD) of South Asian Countries

Year	Afghanistan	Bangladesh	Bhutan	India	The Maldives	Nepal	Pakistan	Sri Lanka
2018	1233	103702	3348	11072694105	408	38	9300297099	935
2019	1271	124118	3204	9222771992	456	46	7831708939	1061
2020	1210	162266	9138	7724512803	169	33	5495665890	1013
2021	460	141269	11017	52396955951	209	33	37747766768	1954
2022	960	142393	13912	7317444455	380	33	5119135523	199

Source: Authors' calculation from remittance data (2018–2022), compiled from BMET, ADB, Central Bank databases, IMF's IFS, and KNOMAD

sharp contrast. Both countries have large populations of first-generation migrants in the Middle East and Malaysia, who remit a significant share of their earnings to maintain household livelihoods. This makes remittances a vital lifeline for poverty reduction and household consumption. For Nepal in particular, remittances account for a large share of GDP, underscoring the country's structural dependence on these flows³⁵). Pakistan also remains one of the world's top remittance recipients, with inflows linked not only to labor migration but also to strong family and cultural obligations that sustain financial transfers³⁷).

Bangladesh represents a major remittance-dependent economy, with labor migration to Gulf States, Malaysia, and, more recently, Europe, forming the backbone of household remittance inflows. These flows contribute significantly to foreign exchange reserves and rural consumption. Unlike India, where migration is more generational, Bangladesh's remittance base is still largely first-generation, meaning remittance behavior is more responsive to employment opportunities and government incentives. The introduction of a formal cash incentive on remittance transfers during COVID-19 further boosted inflows, reinforcing the importance of policy in determining remittance dynamics³⁸).

By contrast, Bhutan and the Maldives are not remittance-dependent economies. Their inflows remain marginal, as these countries have relatively small emigrant populations and rely more on tourism and domestic resources for foreign exchange earnings. Afghanistan, meanwhile, exhibits modest remittance receipts, though these inflows carry heightened importance in the context of political instability and limited formal economic opportunities. Sri Lanka presents a more intermediate case: while remittances are significant, especially for foreign exchange, their growth has been volatile due to economic crises and political transitions.

The yearly data summarized in Table 2 illustrate these contrasts. India overwhelmingly dominates in absolute terms, with inflows exceeding USD 50 billion in 2021, reflecting its vast diaspora and state-level migration networks. Pakistan consistently ranked second, with flows between USD 5–37 billion over the period, while Bangladesh maintained steady growth, with annual inflows surpassing USD 140,000 million in the later years

of the period. Nepal's inflows, though smaller in absolute terms (around USD 33–46 million annually), remain critical in relative terms, forming one of the highest remittance-to-GDP ratios in the region. By comparison, Bhutan, the Maldives, Afghanistan, and Sri Lanka receive modest inflows, underscoring their limited remittance dependence.

These Figures reinforce that remittance in South Asia is not a homogenous regional phenomenon but rather a mosaic of country-specific experiences. Understanding these differences in India's state-driven migration corridors, Pakistan and Nepal's high dependence on first-generation migrants, Bangladesh's policy-driven growth in inflows, and the marginal role of remittances in Bhutan and the Maldives is important for interpreting the determinants of remittance flows during the COVID-19 period and beyond. Table 3 shows Poisson count descriptive statistics of different variables used in this paper. Table 4 shows the result of Poisson Pseudo Maximum Likelihood (PPML) estimation used for the analysis. This is the benchmark estimation.

We estimate six different versions of the extended Gravity Model. The first three models have different independent variables: the number of COVID cases, COVID mortality, and COVID vaccination rollout. The last three versions are the same as the first three versions, but with a country-specific dummy variable and a monthly dummy variable. Except for distance, all six models had the expected results. We assumed that as the distance between the home and the partner countries decreases, remittances will increase. Logically, it seems that where there is a greater distance between countries, the cost of sending money increases, which would deter workers from sending money. However, our results show that as the distance between home and partner countries increases by 1%, remittance inflow increases by approximately 22%. We explain by reasoning that it is because our study mainly observes remittances that are transferred through formal channels. The only way remittance may increase with distance is if geographical proximity makes it easier to use informal, non-observable channels. This finding is supported by^{40,41}); they hypothesize that long-distance migrants are unable to informally transfer, by transferring in-kind or carrying the money themselves, since they return home less frequently.

Table 3: Descriptive statistics

Variable		Mean	Std. dev.	Min	Max	Observations
LNREM	Overall	38.37871	46.57588	0	129.6397	N = 481
	Between		48.25202	0	123.2401	n = 9
	Within		1.523504	31.05988	44.77837	T-bar = 53.4444
LN_MIG_S	Overall	56.46052	57.32737	0	164.6325	N = 481
	Between		60.14915	0	154.0623	n = 9
	Within		4.186768	25.05155	67.03075	T-bar = 53.4444
INCENT~E	Overall	4.864865	7.931506	0	30	N = 481
	Between		6.892024	0	18	n = 9
	Within		4.242641	-13.13514	16.86486	T-bar = 53.4444
LN_GDP_D	Overall	24.04864	26.78726	0	75.7467	N = 481
	Between		26.75902	0	69.06885	n = 9
	Within		8.051866	-45.02021	30.72648	T-bar = 53.4444
LN_GDP_P	Overall	14.26775	13.74354	0	43.17186	N = 481
	Between		13.9952	0	35.01385	n = 9
	Within		3.912486	-15.8381	22.65835	T-bar = 53.4444
LN_DIST	Overall	34.74754	37.27352	0	100.7881	N = 481
	Between		39.00652	0	100.7881	n = 9
	Within		5.05e-14	34.74754	34.74754	T-bar = 53.4444
COL	Overall	.3742204	.4844248	0	1	N = 481
	Between		.5	0	1	n = 9
	Within		0	.3742204	.3742204	T-bar = 53.4444
CONT	Overall	3.991684	4.586204	0	12	N = 481
	Between		4.772607	0	12	n = 9
	Within		0	3.991684	3.991684	T-bar = 53.4444
COMNLANG	Overall	.7484407	1.639716	0	5	N = 481
	Between		1.658312	0	5	n = 9
	Within		0	.7484407	.7484407	T-bar = 53.4444
LANDLO~D	Overall	.3742204	.4844248	0	1	N = 481
	Between		.5	0	1	n = 9
	Within		0	.3742204	.3742204	T-bar = 53.4444
LANDLO~P	Overall	0	0	0	0	N = 481
	Between		0	0	0	n = 9
	Within		0	0	0	T-bar = 53.4444
ISLAND_D	Overall	.2494802	.4331627	0	1	N = 481
	Between		.4409586	0	1	n = 9
	Within		0	.2494802	.2494802	T-bar = 53.4444
ISLAND_P	Overall	.8752599	1.169505	0	3	N = 481
	Between		1.20398	0	3	n = 9
	Within		.0452616	.8585932	1.858593	T-bar = 53.4444
BERI	Overall	479.1715	554.7524	0	1875.848	N = 481
	Between		568.5194	0	1602.009	n = 9
	Within		98.35979	-55.44056	753.0104	T-bar = 53.4444
COVCAS~D	Overall	1.59e+07	7.26e+07	0	4.46e+08	N = 481
	Between		4.12e+07	0	1.24e+08	n = 9
	Within		6.00e+07	-1.08e+08	3.38e+08	T-bar = 53.4444

COVCAS~P	Overall	1.21e+07	2.20e+07	0	1.05e+08	N = 481
	Between		8761152	0	2.29e+07	n = 9
	Within		2.05e+07	-1.08e+07	9.44e+07	T-bar = 53.4444
COVMOR~D	Overall	205929.1	906397.9	0	5286550	N = 481
	Between		522902.9	0	1576555	n = 9
	Within		743486.9	-1370625	3915925	T-bar = 53.4444
COVMOR~P	Overall	158087.7	265519.1	0	1063047	N = 481
	Between		118602.1	0	309460.3	n = 9
	Within		243249.2	-151372.6	911674.4	T-bar = 53.4444
COVVAC~D	Overall	4544488	2.62e+07	0	3.70e+08	N = 481
	Between		8600564	0	2.47e+07	n = 9
	Within		2.48e+07	-2.01e+07	3.50e+08	T-bar = 53.4444
COVVAC~P	Overall	4.10e+07	1.40e+08	0	6.75e+08	N = 481
	Between		6.76e+07	0	1.56e+08	n = 9
	Within		1.23e+08	-1.15e+08	5.60e+08	T-bar = 53.4444

Source: Authors' compilation based on data.

In effect, distance is not a good proxy in our model. Migration stock, however, is a significant determinant of remittance inflow to South Asia. The home country receives more remittances when there are more opportunities to work abroad. The results show that a 1% increase in migration stock results in an approximately 14% increase in remittance inflow. The bilateral exchange rate also positively and significantly impacts remittance. As the exchange rate increases by 1%, remittance inflow increases by 0.00058%, and the estimation is statistically significant at a 1% significance level. Our results are consistent with findings reported by Morley, Rosselló, & Santana-Gallego, 2014, and Olivier, Najar, Cecile, & Pochet, 2021. In addition, traditional gravity variables like common language and common colonial roots have a positive and significant impact on remittance inflow because knowledge of local language and culture makes it easier for migrants to get a job in foreign countries.

Our primary variable of interest, the COVID dummy, is negative and significant in estimations (1) and (2). This implies that remittance inflow decreased by 18% during the pandemic compared to pre-COVID years.

We expected remittance to decrease as per the number of COVID cases. This can be attributed to two possible reasons. Firstly, individuals who work in sectors that are more likely to be affected by the recession will face job losses and low wages. Vulnerable sectors like construction and manufacturing are highly saturated with migrant workers. This was observed during the economic recession of 2008, when there was a 5 to 10 percent decline in global remittance⁴²⁾. Secondly, a possible outcome of COVID-19 spread is a large influx of migrants returning to their home countries. During the Gulf Crisis of 1990-91, Kuwait laid off thousands of Bangladeshi workers and imposed strict control on illegal and undocumented migration⁴³⁾. Taking this crisis as a microcosm, we can assume that the resulting

modest-to-major decline in economic growth in the Global North may trigger migration flows, which ultimately decreases remittance.

Interestingly, Bangladesh is an outlier as COVID-19 caused an increase in remittance inflow. This may be due to the special remittance incentive introduced by the Bangladesh Government. Starting in July 2019, Bangladesh introduced a 2% cash incentive for inward foreign remittance transmitted through official channels like banks, non-bank financial institutions, and money transfer services. Since January 2022, Bangladesh increased the cash incentive to 2.5%. This was effective since unofficial channels were restricted due to international travel bans and containment measures. As a result, expatriate workers were motivated to send money via official channels. Introducing such government incentives to other South Asian countries can be equally effective. We find a 1% increase in incentives that leads to a 17% increase in South Asian remittances. In column (2), we replace the number of COVID-19 cases with COVID-19 mortality and find almost similar results. COVID-19 mortality in South Asia is found to be an insignificant determinant of remittance inflow. However, COVID-19 mortality in partner countries was a positive and significant determinant. As COVID-19 mortality in partner countries increased by 1%, remittance inflow to South Asia increased by 0.000000315%. One possible reason could be that with the increasing COVID-19 death toll, there were more work opportunities for front-line workers who were disproportionately migrants⁴⁴⁾.

Table 4 shows the estimation results using different econometric approaches: PPML, Fixed Effects (FE), and Random Effects (RE). The results highlight the differences in coefficient magnitudes and significance levels across models. The Hausman test suggests that the FE model is preferred, indicating the presence of country-specific

Table 4: Results from PPML

	(1) LNREM	(2) LNREM	(3) LNREM	(4) LNREM	(5) LNREM	(6) LNREM
LN_GDP_D	-0.141*** (0.008)	-0.139*** (0.008)	-0.032*** (0.007)	-0.022*** (0.005)	-0.021*** (0.005)	-0.004*** (0.006)
LN_GDP_P	0.006* (0.003)	0.007* (0.003)	0.011*** (0.003)	0.006* (0.003)	0.007* (0.003)	0.008* (0.003)
LN_MIG_S	0.136*** (0.003)	0.135*** (0.003)	0.131*** (0.003)	0.031*** (0.003)	0.110** (0.003)	0.131*** (0.003)
LN_DIST	0.179*** (0.019)	0.166*** (0.020)	0.166*** (0.019)	0.223*** (0.014)	0.212*** (0.014)	0.215*** (0.014)
COL	0.270*** (0.024)	0.267*** (0.024)	0.254*** (0.023)	0.157*** (0.013)	0.155*** (0.013)	0.154*** (0.013)
CONT	0.398*** (0.036)	0.416*** (0.036)	0.391*** (0.036)	1.146*** (0.044)	1.152*** (0.044)	
LANDLOCK_D	-1.069*** (0.055)	-0.174*** (0.056)	-0.894*** (0.047)	-0.771*** (0.049)	-0.776*** (0.049)	0.599*** (0.046)
ISLAND_P	-0.188*** (0.023)	-0.174*** (0.024)	-0.178*** (0.023)	-0.222*** (0.017)	-0.210*** (0.018)	-0.214*** (0.017)
BERI	0.001** (0.001)	0.001** (0.001)	0.001* (0.001)	0.001*** (0.001)	0.001*** (0.001)	0.001*** (0.001)
INCENTIVE	0.163*** (0.010)	0.163*** (0.010)	0.169*** (0.009)	0.029* (0.013)	0.031* (0.013)	0.024 (0.013)
COVID	-0.174*** (0.015)	-0.181*** (0.015)	-0.173*** (0.014)	-0.038** (0.011)	-0.043*** (0.012)	-0.042*** (0.011)
COVIDCASES_D	-3.61e-10 (6.36e-10)			-4.53e-10 (5.02e-10)		
COVIDCASES_P	3.26e-09*** (4.35e-10)			2.66e-09*** (3.41e-10)		
COVMORT_D		-1.21e-08 (5.17e-08)			-3.52e-08 (4.10e-08)	
COVMORT_P		0.000*** (3.81e-08)			0.000*** (3.02e-08)	
COVVACC_D			-9.60e-09*** (2.01e-09)			-4.50e-10 (2.11e-09)
COVVACC_P			5.76e-10*** (6.52e-11)			3.98e-10*** (5.23e-11)
Year_D	No	No	No	Yes	Yes	Yes
Month_D	No	No	No	Yes	Yes	Yes
Country_D	No	No	No	Yes	Yes	Yes
Cons	-0.784*** (0.155)	-0.686*** (0.159)	-1.286*** (0.160)	-0.806*** (0.109)	-0.741*** (0.113)	-0.823*** (0.122)
N	1935	1935	1935	1944	1935	1944
R-Squared	0.717	0.720	0.706	0.824	0.825	0.819

Heteroscedasticity-consistent standard errors are reported in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Note: Dependent variable LNREM. Standard errors are clustered at the destination-partner country level. Source: Authors' computation

Table 5: Comparing model estimates

Variable	PPML	Fixed-Effects (FE)	Random-Effects (RE)
Ln(GDP Destination)	-0.032***	-0.021***	-0.025***
Ln(GDP Partner)	0.011***	0.008***	0.010***
Ln(Migration Stock)	0.131***	0.110**	0.128***
Ln(Distance)	0.179***	Dropped	0.166***
Incentive	0.169***	0.024	0.031**
COVID Dummy	-0.174***	-0.042***	-0.048***
Hausman Test (p-value)	---	0.02	---

Source: Authors' compilation based on data.

heterogeneity.

Table 5 compares the estimation results from three econometric models, highlighting key differences in the impact of economic and policy variables on remittance flows. The results suggest that economic conditions in both remittance-receiving and migrant-hosting countries play a significant role, with stronger economies in host countries leading to higher remittance inflows, while improved economic conditions in recipient countries reduce reliance on remittances. The size of the migrant population consistently emerges as a crucial determinant, reinforcing the link between migration stock and remittance flows.

Geographical factors also exhibit notable effects, with greater distances between countries appearing to encourage reliance on formal remittance channels. However, in the fixed effects model, such time-invariant factors are absorbed, limiting their explanatory power. The role of government incentives is mixed, as they are significant in some models but not in others, indicating that their effectiveness may be contingent on country-specific institutional frameworks.

The impact of the COVID-19 pandemic is evident across all models, with remittance inflows showing a significant decline during the pandemic period. The magnitude of this effect varies, with the Poisson model capturing a stronger decline than panel models, suggesting that estimation techniques influence the measured impact. The Hausman test results indicate that the fixed effects model is preferred over the random effects model, suggesting that country-specific unobserved factors play an important role in shaping remittance behavior. This underscores the importance of accounting for structural differences between countries when analyzing remittance flows.

Sensitivity analysis

The sensitivity analysis reveals consistent results for most gravity variables, except for distance, which remains counterintuitive. The partner country's GDP and the home country's GDP are identified as significant determinants of remittance flows across all models. We also performed individual Poisson Count estimations for each South Asian nation, treating each country as the domestic country while considering the rest of the world as partners. This approach confirmed that COVID-19 had a predominantly negative

impact on remittance inflows to SAARC countries. However, Bangladesh emerged as an exception, successfully reversing the declining trend due to its targeted government incentive programs. Table 6 provides a summary of the results, highlighting key variables such as the bilateral exchange rate index, migration stock, incentives, and the effects of COVID-19. The analysis shows that variations in the bilateral exchange rate index and migration stock significantly increase remittance flows across South Asia. On the other hand, incentives generally show no significant impact regionally, although they played a pivotal role in Bangladesh's case. Furthermore, remittance flows decreased significantly during COVID-19 across most countries in the region.

To enhance clarity and address reviewer concerns, we expanded the narrative to provide a more detailed explanation of the findings. The gravity variables demonstrate robust consistency across different model specifications, underscoring the reliability of the results. Additionally, the distance variable, while counterintuitive, shows that remittance flows increase with greater distances, supporting the explanation that long-distance migrants are more reliant on formal channels for transferring money, especially during the pandemic when informal methods became less accessible, while detailed results for individual country Poisson Counts are presented in Table 7.

Table 7 shows the pairwise correlation between different variables used in this paper. Table 8 represents the robustness of different estimation results. Result of Pooled OLS represented in columns (1-3), Two-way Fixed-Effects represented in columns (4-6), and One-step system GMM represented in column (7).

Table 9 represents the Variance Inflation Factor (VIF) to represent the multicollinearity of the variables used in this paper.

6. Conclusion and policy recommendations

This study presents evidence of the effect of COVID-19 on South Asian remittance using the Gravity Model. Broadly, we learn that COVID-19 causes a discernible reduction in remittance flow. South Asia's remittance make it crucial to

Table 6: Summary table

Country	Bilateral exchange rate index	Migration stock	Incentive	Covid 19
Afghanistan	↑	↓	---	↓
Bangladesh	↓	↑	↑	↑
Bhutan	↓	↑	---	↓
India	↑	↓	---	---
Maldives	↑	↓	---	↓
Nepal	---	---	---	↓
Pakistan	↓	↓	---	---
Sri Lanka	↑	---	---	---
South Asia	↑	↑	---	↓

Note: ↑ = Increase, ↓ = Decrease, --- = No Impact. The detailed estimation results for each country. Source: Authors' compilation based on data.

Table 7: Pairwise correlation

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) REM	1.000																
(2) CuMig	0.46	1.000															
(3)	(0.312)		1.000														
INCENTIVE	0.005	0.08	0.00	1.000													
(4) GDPD	(0.917)	(0.858)		1.000													
(5) GDPP	0.011	0.380*	0.692*	0.000	1.000												
(6) DIST	(0.818)	(0.000)	(0.000)			0.904	0.502*	0.929*	1.000								
(7) COL	(0.926)	(0.000)	(0.000)	0.904	0.502*	0.909	0.900	0.900	0.900	1.000							
(8) CONT	0.014	0.413*	0.721*	0.933*	0.950*	0.900	0.900	0.900	0.900	0.900	1.000						
(9)	(0.758)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	1.000					
COMNLAN	0.022	0.408*	0.729*	0.999*	0.915*	0.821*	0.800	0.800	0.800	0.800	0.800	0.800	1.000				
G	(0.626)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	1.000			
	0.007	0.396*	0.723*	0.932*	0.946*	0.919*	0.918*	0.918*	0.918*	0.918*	0.918*	0.918*	0.918*	0.918*	1.000		
	(0.881)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	1.000	
	0.036	0.815*	0.040	0.20*	0.37*	0.63*	0.33*	0.50*	0.00								
	(0.435)	(0.000)	(0.378)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)								

(10)	-	-	-	-	-	-	-	-	-	-	1.0								
LANDLOC	0.0	0.1	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.1	00								
K_D	66	78*	10*	55*	53*	97*	98*	05*	96*										
	(0.1	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0									
	47)	00)	00)	00)	00)	00)	00)	00)	00)	00)									
(11)																			
LANDLOC																			
K_P	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)									
(12)	-	-	-	-	-	-	-	-	-	-	1.0								
ISLAND_D	0.0	0.2	0.3	0.3	0.4	0.4	0.4	0.5	0.2	0.4	00								
	49	55*	54*	81*	00*	27*	46*	02*	63*	46*									
	(0.2	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(.)								
	80)	00)	00)	00)	00)	00)	00)	00)	00)	00)									
(13)	0.0	0.3	0.7	0.9	0.9	0.9	0.9	0.9	0.3	-	1.0								
ISLAND_P	09	00*	81*	20*	14*	85*	69*	83*	15*	0.5	0.4	00							
										79*	32*								
	(0.8	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(.)	(0.0							
	38)	00)	00)	00)	00)	00)	00)	00)	00)	00)		00)							
(14) BERI	-	0.3	0.7	0.9	0.8	0.9	0.8	0.9	0.3	-	-	0.9	1.0						
	0.0	25*	60*	10*	94*	47*	85*	64*	70*	0.5	0.3	52*	00						
	04									30*	93*								
	(0.9	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(.)	(0.0	(0.0						
	25)	00)	00)	00)	00)	00)	00)	00)	00)	00)		00)	00)						
(15)	0.0	0.7	0.0	0.3	0.3	0.2	0.2	0.2	0.5	-	-	0.2	0.2	1.0					
COVCASES_D	58	94*	12	63*	21*	99*	84*	85*	51*	0.1	0.1	12*	47*	00					
										70*	27*								
	(0.2	(0.0	(0.7	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(.)	(0.0	(0.0	(0.0					
	02)	00)	95)	00)	00)	00)	00)	00)	00)	00)		05)	00)	00)					
(16)	0.0	0.3	0.0	0.1	0.0	0.0	0.1	0.0	0.1	-	0.0	0.0	-	0.5	1.0				
COVCASES_P	13	84*	16	60*	63	86	25*	52	46*	0.1	0.1	0.0	46*	00					
										30*		01							
	(0.7	(0.0	(0.7	(0.0	(0.1	(0.0	(0.0	(0.2	(0.0	(0.0	(.)	(0.8	(0.2	(0.9	(0.0				
	81)	00)	25)	00)	69)	60)	06)	57)	01)	04)		64)	73)	85)	00)				
(17)	0.0	0.8	0.0	0.3	0.3	0.3	0.2	0.2	0.5	-	-	0.2	0.2	0.9	0.5	1.0			
COVMORT_D	63	00*	17	72*	31*	07*	94*	92*	59*	0.1	0.1	20*	53*	98*	46*	00			
										76*	31*								
	(0.1	(0.0	(0.7	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(.)	(0.0	(0.0	(0.0	(0.0	(0.0			
	69)	00)	17)	00)	00)	00)	00)	00)	00)	00)		04)	00)	00)	00)	00)			
(18)	0.0	0.4	0.0	0.1	0.0	0.1	0.1	0.0	0.1	-	-	0.0	0.0	0.5	0.9	0.5			
COVMORT_P	24	13*	14	73*	90*	02*	48*	64	75*	0.1	0.0	62	03	51*	82*	58*			
										45*	01								
	(0.5	(0.0	(0.7	(0.0	(0.0	(0.0	(0.0	(0.1	(0.0	(0.0	(.)	(0.9	(0.1	(0.9	(0.0	(0.0	(0.0		
	98)	00)	61)	00)	49)	25)	01)	60)	00)	01)		84)	78)	48)	00)	00)	00)		
(19)	0.0	0.1	0.3	0.3	0.2	0.2	0.2	0.2	0.0	-	-	0.2	0.3	0.2	0.0	0.2			
COVVACC_D	22	49*	25*	55*	13*	62*	24*	78*	87	0.1	0.1	67*	02*	32*	88	37*			
										34*	00*								
	(0.6	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(.)	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0		
	25)	01)	00)	00)	00)	00)	00)	00)	58)	03)		29)	00)	00)	00)	53)	00)		
(20)	0.0	0.5	0.1	0.3	0.2	0.3	0.3	0.2	0.2	-	-	0.2	0.2	0.6	0.7	0.6			
COVVACC_P	61	30*	91*	87*	87*	24*	71*	91*	90*	0.2	0.1	86*	21*	70*	34*	79*			
										23*	65*								
	(0.1	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0	(.)	(0.0	(0.0	(0.0	(0.0	(0.0	(0.0		
	83)	00)	00)	00)	00)	00)	00)	00)	00)	00)		00)	00)	00)	00)	00)	00)		

Heteroscedasticity-consistent standard errors are reported in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Note: Dependent variable LNREM. Source: Authors' compilation based on data.

Table 8: Robustness

	(1) LNREM	(2) LNREM	(3) LNREM	(4) LNREM	(5) LNREM	(6) LNREM	(7) LNREM
LN_GDP_D	-0.647*** (0.097)	-0.618*** (0.096)	-0.262*** (0.057)	-0.018 (0.112)	0.011 (0.112)	-0.025 (0.053)	-0.048 (-0.290)
LN_GDP_P	0.057 (0.034)	0.062 (0.033)	0.104** (0.032)	0.021 (0.028)	0.027 (0.027)	0.042 (0.027)	0.054 (0.350)
LN_MIG_S	1.228*** (0.029)	1.213*** (0.029)	1.186*** (0.028)	0.310*** (0.049)	0.303*** (0.049)	0.329*** (0.048)	0.653*** (4.06)
LN_DIST	2.174*** (0.154)	2.022*** (0.155)	1.922*** (0.155)	2.667*** (0.131)	2.538*** (0.132)	2.442*** (0.133)	11.06*** (3.75)
COL	2.114*** (0.262)	2.104*** (0.260)	2.093*** (0.262)	1.077*** (0.222)	1.075*** (0.220)	1.127*** (0.221)	82.42*** (4.76)
CONT	1.097** (0.339)	1.300*** (0.338)	0.891** (0.322)	7.318*** (0.462)	7.419*** (0.459)		-14.64* (-2.53)
COMNLANG	1.571*** (0.187)	1.572*** (0.185)	1.395*** (0.184)	-0.516* (0.225)	-0.545* (0.223)	-0.504* (0.224)	6.370*** (6.08)
LANDLOCK_D	-5.883*** (0.330)	-6.061*** (0.330)	-5.382*** (0.305)	-4.778*** (0.515)	-4.822*** (0.512)	2.495*** (0.517)	15.36* (2.30)
ISLAND_P	-1.706*** (0.203)	-1.576*** (0.203)	-1.548*** (0.204)	-2.004*** (0.170)	-1.884*** (0.170)	-1.850*** (0.170)	-2.984 (-0.16)
BERI	0.002** (0.000)	0.002** (0.000)	0.001* (0.000)	0.004*** (0.000)	0.004*** (0.000)	0.004*** (0.000)	-0.013 (-1.51)
INCENTIVE	1.366*** (0.088)	1.388*** (0.088)	1.383*** (0.083)	0.243* (0.097)	0.275** (0.096)	0.197* (0.096)	1.467*** (6.89)
COVID	-1.848*** (0.145)	-1.939*** (0.146)	-1.661*** (0.136)	-0.512*** (0.131)	-0.586*** (0.132)	-0.459*** (0.123)	-1.305*** (-4.39)
COVCASES_D	-2.42e-10 (6.81e-09)			-4.26e-09 (5.99e-09)			
COVCASES_P	5.13e-08*** (5.96e-09)			4.64e-08*** (5.08e-09)			
COVMORT_D		0.000 (0.000)			-0.000 (0.000)	-2.95e-09 (1.47e-08)	
COVMORT_P		0.000*** (0.000)			0.000*** (0.000)	9.02e-09*** (8.41e-10)	
COVVACC_D			-7.52e-08*** (1.68e-08)			18.77*** (1.174)	
COVVACC_P			1.13e-08*** (1.00e-09)				
Year_D	No	No	No	Yes	Yes	Yes	No
Month_D	No	No	No	Yes	Yes	Yes	No
Country_D	No	No	No	Yes	Yes	Yes	No
_cons	-23.01*** (1.374)	-21.97*** (1.376)	-22.68*** (1.348)	-20.91*** (1.267)	-20.14*** (1.265)		
N	1935	1935	1944	1935	1935	1944	1944
R-Squared	0.692	0.697	0.692	0.790	0.793	0.790	
Adjusted R- squared	0.689	0.694	0.690	0.787	0.790	0.790	

Heteroscedasticity-consistent standard errors are reported in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Note: Dependent variable LNREM. Standard errors are clustered at the destination-partner country level. Pooled OLS (1, 2, 3), Two-way Fixed-Effects (4, 5, 6), and One-step system GMM (7). Source: Authors' compilation based on data.

continue the surge of migrant workers to maintain a flourishing economy. We find considerable evidence that migration stock and bilateral exchange rates promote remittance. We also observe that in Bangladesh cash incentives policies have a favorable impact on remittance despite the pandemic. This means specialized country-

specific government programs may be beneficial. Thus, during times of crisis, policymakers are encouraged to take into consideration migration stock, bilateral exchange rates, and government incentives. Future research could benefit from incorporating additional variables such as stringency indexes and short-term working schemes in partner and

Table 9: Variance Inflation Factor (VIF)

	VIF	1/VIF
COVMORT D	258.388	.004
COVCASES D	249.838	.004
COVMORT P	44.886	.022
COVCASES P	42.697	.023
COVVACC P	3.619	.276
LN DIST	3.556	.281
LANDLOCK D	2.671	.374
ISLAND P	2.09	.478
INCENTIVE	2.018	.496
CONT	1.95	.513
COVD	1.785	.56
LN MIG S	1.734	.577
COL	1.645	.608
LN GDP P	1.506	.664
LN GDP D	1.506	.664
COMNLANG	1.501	.666
COVVACC D	1.212	.825
BERI	1.178	.849
Mean VIF	34.655	.

Note: Dependent variable LNREM. Source: Authors' compilation based on data.

destination countries. These variables could provide a more nuanced understanding of how COVID-19 policy responses impacted remittance flows. Although these were not included in the present analysis due to data and resource limitations, their inclusion in future studies would enrich the findings and provide additional robustness. Moreover, researchers might incorporate dynamic and more disaggregated levels, like informal remittance behavior, in future research.

This study goes on to reveal significant insights into the roles that COVID-19-related factors play in determining the dynamics of remittances. By utilizing the COVID-19 dummy variable, we can determine how COVID-19 transmission, mortality, and vaccination rates affected remittance both domestically and internationally. We find that as the death toll increases, remittance increases, and as vaccination rates surge, so does remittance. However, COVID-19 cases and remittances have a negative relationship. The findings of this research, taken as a whole, offer an important contribution to the current body of literature on South Asian remittances and supply policymakers with the unique difficulties posed by the pandemic. Considering the results, we compile policy recommendations as follows:

Enhancing Sector-Specific Skill Labor Migration: Encouraging the development of sector-specific skills among the labor force can lead to higher earning potential abroad. This will diversify the labor force so that the migrant workers are not stuck in sectors that are easily hit by the recession or as physically grueling as for front-line workers. Governments can invest in vocational training programs and skill development initiatives to equip workers with the necessary expertise that is in demand in

destination countries. This can attract higher wages and better employment opportunities, resulting in increased remittances.

Promoting Incentives for Official Channel Remittances: Governments can provide incentives for migrants to use official channels for sending remittances. This can include reduced fees or transaction costs, preferential exchange rates, or tax benefits for remittances sent through formal channels. This makes it easier for policymakers to notice the patterns of remittance as the exchange is solely happening through an observable channel.

Strengthening Collaboration and Partnerships: Governments should collaborate with relevant stakeholders, including financial institutions, international organizations, and diaspora communities, to promote legal remittance flows. Partnerships can facilitate knowledge sharing, capacity building, and the development of innovative financial products and services tailored to the needs of migrant workers. By implementing these policies and strategies, South Asian countries can create a suitable environment for legal remittance flows, attracting a higher volume of remittances and contributing to economic development and poverty reduction in the region.

The economic conditions of both the partner (host) country and the home country play an important role in influencing remittance flows. Specifically, "partner country's GDP" and "home country's GDP" were found to be significant factors across all the models. This indicates that when the economies of both countries are performing well, remittance flows tend to increase. For policymakers, this finding emphasizes the importance of maintaining strong economic relations with remittance-sending countries. Agreements with host countries to ensure better opportunities and stability for migrants can help sustain remittance inflows. At the same time, improving home countries' economic growth and creating better job opportunities locally can encourage a positive cycle of remittance growth. By focusing on these areas, the government can ensure that remittance flows remain a key source of economic support and development for the country.

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