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Determinants of Remittance Inflows to Bangladesh: A Gravity Model Approach using Panel Data

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Abstract

This paper examines the determinants of remittance inflows to Bangladesh considering the vital role it plays in the economy of Bangladesh and the ability of the gravity model to explain cross-country flows of remittances. Application of the gravity model to international trade and migration may provide valuable insights in explaining the underlying determinants of cross-border flows such as remittances and take effective policy actions in the face of any unforeseen adverse shock as seen in the negative remittance growth in 2013. We, therefore, apply a gravity model of remittances to a panel dataset comprising 13 countries for 2002-2013. Our study incorporates several additional economic factors e.g., consumer prices, unemployment rate, credit by the financial system, output gap in migrant destinations relative to Bangladesh, the presence of bilateral labor trade agreements between two countries, whether the migrant destination country is an oil exporting country or not, in addition to typical gravity variables. Results of estimated models show that GDP per capita, migrant stock, foreign exchange rate, and output gap are significant determinants of remittances at conventional significance levels.

Key words : Remittance flows, migrant stock, gravity model, panel data models, and geographical distance

JEL classification : F22, F24, J61, J71, O11, O24, C23

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I. Introduction

Remittance inflows provide lifeline to millions of Bangladeshi migrants and their families through the creation of employment, smoothening of consumption, and unlocking of investment opportunities. Most researchers and policymakers now recognize that remittances inflows play notably positive roles in sustaining Bangladesh's current account balance, comfortable foreign exchange reserve, stable foreign exchange rate, diminishing foreign aid dependence and declining poverty rates. In fact, external sector in most countries of South Asia such as Nepal, Bangladesh, and Pakistan will be rendered vulnerable in the absence of sustained remittance inflows.

Official data on remittances to Bangladesh is available from 1976 onwards. During this period, remittance inflows exhibited a notable upward trend as a percentage of GDP. From a tiny 0.19% of GDP, these flows grew to 1.87% in 1980 to 3.74% in 1983 and in the following years till 2000 remittances hovered around 2.32% and 3.95% with a fluctuating but gradually increasing trend and crossed the 4% mark in 2001. Since 2001 till 2012 remittances displayed an impressive upward drift amid some minor fluctuations. Remittances as percentage of GDP first a hit double-digit level (10.07%) in 2008 and rose to 10.68% in 2012. However, in 2013 remittances as percentage of GDP decelerated to 9.24% owing to crackdown of illegal migrants in the middle- east countries.

Bangladesh experienced negative remittance growth of 1.8% compared to the previous year (World Bank). The negative remittance growth alerted concerned migrants and policymakers with regard to prospects of future remittance inflows. Fortunately, remittances rebounded and posted significantly positive growth rate.

Since sustainable inflows of remittances and their occasional lapses play crucial importance in the economic stability of Bangladesh, a comprehensive understanding of the underlying factors is vital. Literature abounds on the microeconomic and macroeconomic determinants of remittances regarding other countries but studies explaining the case of Bangladesh is inadequate. In particular, comprehensive theoretical and empirical studies on Bangladesh are scant. The gravity model of remittances may reveal the underlying factors of remittance inflows as it has helped explain cross-country flows of trade, foreign direct investment, migration, and remittances in previous studies and provided valuable insights on the factors determining these international flows.

The current study applies the gravity model to examine the major determinants of remittance flows to Bangladesh. Although a number of studies investigated the determinants of remittance flows to Bangladesh, it is important to check whether the remittance flow dynamic still holds relevant for policy makers. Our study applies a number of panel data analysis techniques with various specifications to estimate and test if the estimates are consistent and robust. We also attempt to augment the gravity model to test the influence of a number of macroeconomic variables, e.g., consumer prices, unemployment rate, credit by the financial system, output gap in migrant destination countries relative to Bangladesh.

The rest of the paper is organized as follows. The next section surveys relevant literature (Section II). Based on literature survey and data availability, we attempt to develop the model, data set, and estimation methods (Section III). Then we estimate and report our results (Section IV). Finally, we conclude, and discuss some policy implications (Section V).

II. Literature Review

The existing body of literature on the determinants of remittances is growing in terms of the variety of data coverage, methodology, and approaches due mainly to its vital importance in the economy of many countries across the world. Both theoretical and empirical, microeconomic and macroeconomic studies on remittances are available that highlight different aspects of the determinants of remittances. This paper will mostly be limited to explore, develop, and then apply a gravity model of remittances to explain the factors influencing remittance inflows to Bangladesh.

The application of Newton's gravity (1867) model in economics traces back to Tinbergen's (1962) pioneering paper to explain the determinants of international trade flows. Like Newton's gravity model (which explains the force of gravitation between two bodies in the universe based on the mass of the two bodies and the distance between them), the gravity model of trade also tried to explain the determinants of trade based on the size of GDP between two economies and the geographical distance between them.

Following Head (2003) we may express the gravity equation for bilateral flows as

$$F_{ij} = G\frac{M_i^{\alpha} M_j^{\beta}}{D_{ij}^{\theta}}$$

where F_{ij} stands for bilateral flows from country i (e.g., remittance sending country) to country j (e.g. remittance receiving country), Gisa gravitational constant, M_i and M_j denotes the size of GDP of country i and j respectively with α, β showing the elasticity of the two countries, D_{ij} is the distance between country i and country j and θ is the elasticity of F_{ij} with respect to D_{ij} .

Since his pioneering work, many researcher examined flows of international trade, migration, foreign direct investment, and remittances by using the gravity model. Fortunately, despite having no theoretical basis in economics, the gravity model could be successfully applied to empirical analysis of these macroeconomic variables and produced useful results.

The gravity model of remittances is an important extension to this literature trying to examine the determinants of remittances. Most studies on the determinants of remittances highlighted either microeconomic or macroeconomic determinants of remittances. A number of studies also attempted straightforward atheoretical replication of the Gravity

model in the tradition of the gravity model of trade though gravity models of trade are already grounded in economic theories. We have not seen the application of economic theory-based gravity model of remittances in Bangladesh context.

Drawing upon insights from Sjaastad (1962), Wadycki (1973), Greenwood (1975), Schultz (1982), and Borjas (1987, 1989), a study by Karemera et al. (2000) developed and examined a labor-theory based gravity model of international migration to North America using panel data analysis. The labor-theory based gravity model of migration by Karemera et al. (2000) was compatible with the analysis of international migrant flows revealing that in addition to population and income variables, political variables were also important determinants of migration.

In contrast, Lueth and Ruiz-Arranz (2006) examined an atheoretical gravity model of remittances by using a panel dataset of bilateral remittance flows for selected countries over the 1979-2004 period and found that a few gravity variables were able to explain remittance flows although their finding did not show complete conformity with predictions by other studies on a number of variables. The study found significant impacts of the gravity variables such as the size of GDP and the distance across countries although it found mixed evidence on the motives to remit, altruism or investment.

This paper paper develops and applies a gravity model of remittances similar to Karemera et el. (2000) attempting to consider some economic reasoning for the variables in addition to conventional gravity variables compared to atheoretical application of the gravity model in Lueth and Ruiz-Arranz (2006).

Ahmed and Martinez-Zarzoso (2014) applies a gravity model using replacing distance with transaction costs.The study finds that economic performance of the migrant's home country has significant effect on remittances. The study also finds that migrants tend to send more remittances during political instability, which supports the countercyclical and altruistic motive to remit.

Mahapatra and Ratha (2010) highlighted three factors in determining the flow of remittances, namely, stock of migrants in different migrant-destination countries, the incomes in the migrant sending countries, and income in the migrant sending countries. Ratha and Shaw (2007), Freund and Spataforta (2008), Lueth and Ruiz-Arranz (2008), Sing et al. (2009) cited in Mahapatra and Ratha (2010) identifies the size of emigrant stock as the most important determinant of remittances. Unfortunately, the stock of emigrants is neither recorded nor estimated in Bangladesh since no records on returnee migrants are maintained although the data on flow of outbound Bangladeshi migrants is available.

Sayan (2012) and World Bank (2005) found that remittances are counter-cyclical in poor countries like Bangladesh and India (which supports altruistic motive) whereas these flows are pro-cyclical in middle-income countries.

Dustmann, and Mestres (2010) examined if there is any distinction between temporary and permanent migration in terms of remittances sent to migrant's home countries and found

that the type of migration plan, i.e. the nature of return plans were related to large changes in remittance flows.

Nighat and Balgrami (1993) investigated the determinants to Pakistan and found both altruism and self-interest as migrants' motives for sending remittances to Pakistan. The study also suggested that unskilled workers tend to remit more than skilled workers.

Our paper contributes to the existing literature of the gravity model of remittances in the following ways. First, we fill in gap in literature on the gravity model of remittances on Bangladesh, Second, we develop a gravity model that is closely aligned with economic reasoning in examining remittance flows. Third, in order to investigate the factors affecting the flow of remittances we attempt to identify a number of variables that were not so far examined in the literature. Fourth, we attempt to estimate migration stock, one of the most important determinants of remittances, from available stock data that are sporadic by nature but we combined it with migrant flow data and average number of years migrants tend to stay in the destination countries. Finally, we also examine the effect of two potentially important dummy variables, namely the presence of manpower trade agreements between Bangladesh and destination countries and whether the destination country is an oil exporting country.

III. Model. Data,and Methodology

The Gravity Model

This paper derives a gravity model of remittances arguments of Karemera et al (2000) in economic modeling of the equation of gravity suggested by Wadycki (1973), Greenwood (1975), Schultz (1982), and Borjas (1987,1989).

Our benchmark gravity model of remittances may be represented as

$$lrem_{jb}=\alpha_j+\beta_1 lgpc_{jb}+\beta_2 ldist_{jb}+\beta_{23} lmig_{jb}+\beta_4 fxr+\in_{jb}$$

where $j=1,\ldots,13$ which represent the destination countries of migrants, b stands for Bangladesh, and $\in$ represents the stochastic disturbance term. All the variables are expressed in natural logarithm and the time subscript t is dropped for convenience. The β s are parameters to be estimated.

On the other hand, the augmented gravity model of remittances be expressed as follows:

$$lrem_{jb}=\alpha_j+\beta_1 lgpc_{jb}+\beta_2 ldist_{jb}+\beta_{23} lmig_{jb}+\beta_4 fxr+\beta_5 lrelp_{jb}+\beta_6 relu_{jb}+\beta_7 relc_{jb}+\beta_8 opg_{jb}+\delta_1 mou_{jb}+\delta_2 oec_{jb}+\in_{jb}$$

where δ_1 and δ_2 are parameters of the dummy variables: whether a bilateral labor contract between migrant destinations and Bangladesh (*mou*) exists and whether the migrant destination is an oil exporting country *(oec)*. Other additional variables in the augmented model are price levels (relp), unemployment rate (relu), credit by the financial sector (relc), and output gap (opg) (as a percentage of GDP) in migrant destinations relative to Bangladesh respectively.

Data

We use yearly remittance[5] inflows to Bangladesh from 13 migrant destination countries (the dependent variable in the model) out of 18 countries for which remittance data is available from Bangladesh for the period beginning in financial year 2002 and ending in the financial year 2013. We could not take the remaining 5 countries as data on migrant flows were not available from BMET (Bureau of Manpower, Employment, and Training). Nevertheless, we observe that on average remittance inflows from these 13 countries account for around 82% of total remittance inflows to Bangladesh over the period 2002-2013.

The explanatory variables in our gravity model of remittances are GDP per capita of migrant destination countries relative to Bangladesh, flight distance from Bangladesh to major destination airports, destination-wise stock of Bangladeshi migrants (estimated from, outbound migrants from Bangladesh), foreign exchange rate in migrant destination relative to Bangladesh, Consumer Price Index of destination countries relative to Bangladesh, unemployment rate of destination countries relative to Bangladesh, Credit by financial sector relative to Bangladesh, Output gap as percentage of GDP relative to Bangladesh, whether there is bilateral manpower export agreement (mou) between Bangladesh and destination countries (1 if yes, 0 otherwise), and whether the country is an oil exporter (oec) (1 if yes, 0 otherwise).

In short, this our study examines a number of important economic, demographic, and geographic variablesthat the literature on the gravity model of migration and remittances suggested. Furthermore, as suggested by Ahmed and Martinez Zarzoso (2015) we also considered including the cost of sending remittances in our gravity model but we had to drop it as we could not find such data before 2008. A list of the dependent variable and explanatoryvariables of the model is presented in Appendix-1.

We investigate two broad types of gravity model of remittances: (1) the baseline gravity model, and (2) the augmented gravity model. In the baseline gravity model, we examine the relationship between the remittances inflows to Bangladesh and the following variables: the size of GDP in migrant destination countries relative to remittance-receiving countries (lgpc), the distance between Bangladesh and migrant destinations (ldist), the number of Bangladeshi migrant working in destination countries (lmig) and foreign exchange rate between remittance sending countries and Bangladesh.

In accordance with the gravity model, it is assumed that countries with higher per capita GDP level will attract migrant workers from countries with lower per capita GDP because the wage earning potential is higher in countries with higher per capita income. Similarly, the greater is the number of migrant stock in migrant destinations, the more will

5 Remittance flows in this study mean remittance inflows through official channels such as banking channels but does not include unofficial remittance inflows such as those by hundi or by any other unofficial/illegal channels.

be the remittances sent to their home country. Regarding exchange rates, the more Taka Bangladeshi workers get with fewer foreign currencies, the more remittances they will send to Bangladesh. In contrast, the greater the distance between two countries is, the less likely will the level of remittance flows between the two countries because distance will discourage migration possibly for high cost of migration and sending remittances.

In the augmented gravity model, we incorporated the following variables: consumer prices (relp), unemployment (relu), credit offered by the financial system (relc) and output gap (opg)[6] as explanatory variables. We also considered two dummy variables such as whether any memorandum of understanding exists between migrant destination countries and Bangladesh (mou), and whether the countries migrants are working are exporters of oil (oec) because these variables may be positively related to remittances as well.

Limitations

The study on the gravity model of remittances is constrained by availability and quality of data. For instance, despite the importance of the stock of migrants as a major determinant of remittances, no such data is available. Because of its potentially important role in remittances we estimated it using a 6-year cumulative sum[7] for each year for 2002-2013 period. For the dummies such as mou and oec, we depended on information gathered from newspaper reports and other sources.

On the other hand, variables listed in the model do not necessarily exhaust the list of important determinants. Literature lists a host of other important variables that typically have important effects on remittances such as wage rates, the cost of migration in terms of travel cost and employment arrangement, the cost of sending remittances, and the role of access to networks of exchange houses, skill and education level of migrant workers, drawing arrangement and banking system in delivering remittances, just to mention a few. However, there is either no recorded panel data on these variables or there is insufficient data that makes use of these variables difficult and often impossible.

Estimation Methods

We apply several panel regression methods to estimate the gravity model of remittances. In particular, we applyapplied pooled ordinary least squares (OLS), fixed effects (FE), random effects (RE), Hausman-Taylor and Mundlak estimation approaches to panel data analysis. We would also test robustness of the model by inspecting a number of alternative specifications.

We estimate pooled OLS with corrections for heteroscedasticity. The estimated parameters

6 Output gap in migrant destination countries (opg) was calculated using Hodrick-Prescott filter.

7 The expected duration of stay of expatriate Bangladeshi migrant workers is 6 years calculated as a weighted average of the duration reported in the Survey on the Use of Remittances (SUR) 2013 published by Bangladesh Bureau of Statistics.

of pooled OLS regressionare consistent if we assume the explanatory variables and the unobserved fixed effects are uncorrelated. However, this assumption may not often hold and if we estimate parameters in that situation, the parameters may contain unobserved heterogeneity bias (Hsiao, 2008). The decision on whether pooled OLS or FE model is consistent may be made by running restricted F-test and Breuch and Pagan LM test.

The bias in estimates may remedied by fixed effects and random effects models that account for unobserved heterogeneity albeit in different ways. In fixed effects model, the unobserved fixed effects are eliminated and so the parameters estimated are consistent.

On the other hand, random effects model assume that the unobserved effects are random and accordingly these effects are subsumed in the error term. If the unobserved effects are in fact random, estimated parameters of random effects model are consistent. However, it is not possible know a priori whether random effects or fixed effects model is appropriate. To identify which of these two model produces more consistent estimates of parameters we may use Hausman test. The null hypothesis of Hausman test is that the random effects is more consistent. If we reject the null hypothesis in Hausman test, we may infer that the individual fixed effects are correlated with the regressors, and hence the estimates of random effects modelare consistent.

In contrast, if fixed effects model turns out to be consistent, we still have problem because the fixed effects estimator eliminate time invariant variables. To overcome this problem, Mundlak (1978) treat country-specific effects as a function of the mean of time-variant variables. Considering its usefulness, we estimate the regression using Mundlak approach as well.

In spite of consistency of estimates we still face the problem of endogeneity or reverse causality. Fortunately, Hausman and Taylor (1981) estimatiom method address this issue by relaxing the exogeneity assumption inherent in pooled, FE and RE models to allow some of the regressors to be endogenous. The Hausman-Taylor approach treats the means of the exogenous time-variant variables as instruments for the endogenous variables.

Finally, we also perform diagnostic tests to guard against autocorrelation and heteroscedeasticity problems by employing appropriate tests. We use robust standard errors in our gravity model of remittances.

IV. Empirical Results

As indicated in the previous section, we first estimate a benchmark gravity model of remittances considering typical gravity variables such as per capita GDP of migrant destination relative to Bangladesh, distance between Bangladesh and migrant destinations, migrant flows from Bangladesh to these countries, and exchange rate in these countries with Bangladesh. In our benchmark gravity model, we estimated both fixed and random effects and tested which of the models was consistent by applying Hausman test. (Table-4.1).

The estimated Chi-squared statistic was 2.70 which was significant at all conventional levels of significance and hence we failed to reject the null hypothesis that random effect

model was consistent. Estimated parameters of the random effects model under the baseline gravity model showed that lgpc, lmig, and fxr were significant at 1% level while ldist was insignificant at all conventional level of significance. The results conform to theoretical expectation regarding the sign and effect of lgpc, lmig and fxr on remittances except ldist which implies that ldist is insignificant although it has the expected negative sign.

Table-4.1: Regression Results of the Benchmark Gravity Model

Dependent Variable: irem				
	Fixed Effects Model		**Random Effects Model**	
Regressors	Coefficient	Standard Errors	Coefficient	Standard Errors
lgpc	2.02*	3.44	2.01*	0.31
ldist	-1.01	2.14	-0.82	1.14
lmig	0.43*	0.05	0.42*	0.05
fxr	-0,30*	0.10	-0.21*	0.07
Hausman Test	**Chi-squared Statitistic**		**p-value**	
	2.70		0.61	

On the other hand, in the augmented model (Table-2.2), in addition to those examined in the baseline model, we examined the effect of relative consumer prices, unemployment rate, credit availability, governance ranking, and output gap. Furthermore, we introduced two dummies such as the existence of bilateral manpower agreement and whether the country of destination is an oil exporting countries. Again, we ran both fixed and random effects model and Hausman test to decide upon which model was consistent. Like the baseline case, result of Hausman test suggested that random effect model was consistent in case of the augmented gravity model too. The significance of parameters in the baseline line sustained in the augmented model too. However, in addition output gap was found significant at 10% level although the rest of the variables showed insignificant coefficients. Between two dummies we introduced, only mou appears to be significant while oil exporting status of countries turned out to be insignificant. The significance of mou indicates government initiatives do play a positive role in remittance inflows from destination countries of Bangladeshi migrants.

The coefficient on lgpc is 2.1 which means 1% increase in relative GDP per capita in destination countries lead to 2.1% increase in remittance inflows. Similarly, 1% increase in migrant stock is associated with 0.43% increase in remittance inflows. These results conform to the expected result of the gravity model in that migrants are attracted to destination countries for the higher income level and corresponding higher wage level in destination countries. We could not get wage rates for the countries in our sample, and so we depend on relative GDP per capita as a proxy gravity variable for wage rate. However, these results are suggestive of importance of gravity variables in determining remittance inflows.

Table-4.2: Regression Results of the Augmented Gravity Model

Dependent Variable: irem				
	Fixed Effects Model		**Random Effects Model**	
Regressors	Coefficient	Standard Errors	Coefficient	Standard Errors
lgpc	2.01***	0.41	2.10***	.37
ldist	-1.03	2.10	-0.05	1.26
lmig	0.40***	0.07	0.37***	0.05
fxr	-0,30***	0.10	-0.27***	0.08
relp	-0.10	0.15	-0.08	0.14
relu	-0.08	0.33	-0.27	0,29
relc	-0.03	0.29	1.53	0.22
relr	-0,03	0.03	-0.03	0.02
opg	-0.002*	0.001	0.002	0.001
mou	2.43*	0.92	1.72**	0.77
oec			-0.97	1.29
Hausman Test	**Chi-squared Statistic**		**p-value**	
	6.95		0.64	

In addition, we wanted to see whether fluctuation in output as measured by output gap in destination countries had positive or negative effects on remittance flows. A significant (at 10% level) but negative coefficients on output gap in destination countries relative Bangladesh suggests that economic fluctuations in destination countries results in lower remittance inflows to Bangladesh. This finding is supportive of the essence of gravity model of remittances in that it indicates that stability in real GDP in destination countries matter more for remittances since it means stability in employment and wage in these countries as well.

On the other hand, none of the coefficients on ldist, and relp, relu, relc, and relr were found significant at even at 10% significance level meaning that distance between Bangladesh and destination countries, price level, unemployment rate, credit availability, and governance ranking of destination countries relative to Bangladesh in destination countries do not significantly affect remittance inflows to Bangladesh.

Interestingly, the coefficient on consumer prices in destination countries relative to Bangladesh has negative sign as expected although the parameter is insignificant. In general, the estimated fixed model in this study finds evidence in favor of most of the gravity variables that existing literature considers.

On the whole, it appears that the inclusion of additional macroeconomic variables improved the performance of the model in terms of explaining what determines remittance inflows to Bangladesh. Nevertheless, the model could be better specified and estimated if the data on

the following were available: Bangladeshi migrant stocks in destination countries, the cost of migration, the cost of sending remittances, migration policies in destination countries and the bilateral contractual relationships (memorandum of understanding, i.e., mou) on manpower exports between migrant destination countries and Bangladesh.

In order to check robustness of the model we also estimated the parameters by applying Mundlak and Hausman Taylor estimation methods. In general, results of our estimation with these methods (Appendices) support our estimation by random effects model that was suggested by Hausman tests we discussed earlier.

V. Summary and Conclusion

In this study we attempted to investigate whether the gravity model of remittances can explain remittance flows to Bangladesh. We examined traditional gravity variables such as migrant stock, distance, GDP per capita, and foreign exchange rate and found support evidence in favor the gravity variables in benchmark model except distance. In the augmented model, we incorporated additional variables that might potentially act as gravity variable, namely, the price level, unemployment rate, credit by the financial system, output gap, and governance ranking in destination countries relative to Bangladesh and existence of bilateral relation between migrant host countries and Bangladesh. Except output gap and bilateral agreements all other additional variables appear insignificant.

Our findings suggest that remittances are generally affected by both supply and demand for migrant labor as predicted by the gravity model. The economic conditions in destination countries appear to matter in hiring migrant workers as displayed in significant coefficients of unemployment rates and output gap in those countries. Rising unemployment in migrant destinations, particularly in the middle-east, may shrink employment (if not for household workers who are paid very low wages!) and wages and hence remittances in future. External economic shocks may transmit through migration and remittance channels to Bangladesh and destabilize macroeconomic stability from a disproportionate dependence on overseas employment and remittances for the external sector stability of Bangladesh. However, we think that a more in-depth analysis is required for making conclusive remarks on the link between unemployment in the destination countries and that in Bangladesh.

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