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Inward Worker Remittances and Economic Growth: The Case of Bangladesh

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Abstract

It is commonly believed that for development economies, inward worker remittances are an important financial instrument to boost economic growth. This study investigates the relationship between inward worker remittances and economic growth for the case of Bangladesh. The study applies an Autoregressive Distributed Lags (ARDL) bounds testing approach based on 28 years of World Bank and IMF data. The paper adds to the literature by considering Foreign Direct Investment (FDI) and Official Development Aid as additional foreign sources of economic growth. In contrast to common belief and most prior results, the findings of this study indicate that worker remittances do not have a significant impact on economic growth. Rather, economic growth is mainly spurred by changes in Bangladesh's capital stock and by FDI inflows. Thus, while worker remittances are certainly important for receiving families, their impact on economic growth needs to be enhanced by incentivizing a more growth-conducive use of remitted funds.

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1. Introduction

Worker remittances have become a common phenomenon in the global money transferring market over the past decades. Worker remittances are generally referred to as the personal money transfer from migrated workers to their families back home. Although motivation and utilization of remittances vary by case, the recipients of remittances likely depend on the remitted funds to sustain their living (Hussain, 2014; Carrasco & Ro, 2007). Moreover, worker remittances are frequently perceived to be an important financial source to accelerate economic growth, especially for (low-skilled) labor-exporting countries (Al-Assaf & Al-Malki, 2014; Sutradhar, 2020). Worker remittances may also have a significant role in strengthening the balance of payments and foreign currency earnings (Das, McFarlane, & Jung, 2019; Akther, Masuduzzaman, & Chakraborty, 2017; Kuntal, 2010). However, on the negative side, as Sutradhar (2020) explains, worker remittances imply that people leave the home country to work abroad. This may lead to a brain drain with negative consequences for the home country's growth potential. Moreover, while foreign currency earnings may be strengthened by worker remittances, this may lead to an appreciation of the local currency which, in turn, reduces the home country's competitiveness on international goods and services markets.[1] In addition, worker remittances may lead to a fall in the labor supply in the home country in case remittance-receiving families use the overseas non-labor income to demand more leisure time (Sutradhar, 2020).

World Bank data indicate that worker remittances to low and middle-income countries amount to about US-$529 billion in 2018. From 1990 to 2018 worker remittances to these countries are three times larger than ODA - Official Development Aid (World Bank, 2018; World Bank, 2019). Bangladesh is no exception. This country receives about US-$15.57 billion in worker remittances in 2018, which is about 5.65% measured against Bangladesh's GDP. Bangladesh is the ninth

[1]However, Barai (2012a) argues that Bangladesh's export sector has not been affected by "Dutch Disease effects" stemming from worker remittances.

largest remittance-receiving country worldwide and it ranks third in Asia (New Age, 2019; Migration News, 2019; Dhaka Tribune, 2018).[2]

Inward worker remittances as a percentage of GDP to Bangladesh have been consistently upward trending since the mid-1970s. The only exceptions are the years around the Global Financial Crisis and, more recently, around 2017 when migrated workers use illegal channels for transferring money back home due to the lower exchange rate of the US-$ against the Bangladeshi Taka (The Daily Star, 2018).[3] Given their quantitative importance, worker remittances are frequently seen as a main accelerator for improvements in living conditions and economic growth and, in turn, as a key drag on Bangladesh's unemployment rate (Sarker & Islam, 2018; Barai, 2012a; Barai, 2012b; Nath & Mamun, 2012).

Several studies delve empirically into the relationship between worker remittances and the economic growth performance of Bangladesh. Paul and Das (2011) apply the Johansen co-integration approach to data for the period 1979 to 2009. They find evidence in favor of a positive long-run relationship between worker remittances and GDP. However, in the short run, GDP does not respond to movements in worker remittances. Their empirical model includes only worker remittances and GDP.

Chowdhury (2011) deals with the effect of worker remittances on financial development in Bangladesh. He finds that remittances Granger-cause Bangladesh's financial sector development. Financial development, in turn, exerts a positive effect on economic growth (Valickova, Havranek, & Horvath, 2015).

Shimul (2013) uses data from 1976 to 2007 and inter alia an ARDL bounds testing approach. His findings suggest that worker remittances and economic growth are statistically unrelated. His empirical model also includes a variable capturing Foreign Direct Investment (FDI). FDI shows a positive association with economic growth in the short run and a negative, albeit statistically insignificant, relationship in the long run.

Kumar and Stauvermann (2014) investigate the impact of worker remittances on Bangladesh's economic growth using data from 1979 to 2012. They apply an ARDL bounds testing

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[2]For evidence on the socio-demographic characteristics of Bangladeshi workers working abroad and of their families, respectively, see Hussain (2014).

[3]See Sutradhar (2020) on various channels to transfer remittances back home to Bangladesh and Hussain (2014) on their relative importance.

approach. Kumar and Stauvermann (2014) thoroughly derive their empirical model from neo-classical growth theory. It, therefore relies on variables measured in per-worker terms and it includes capital stock per worker in addition to GDP and worker remittances, also measured in per-worker terms. Kumar and Stauvermann (2014), too, find that worker remittances have a significant positive impact on Bangladesh's economic growth in the long run. In the short run, these authors report that worker remittances are negatively associated with economic growth. This latter finding is consistent with Sutradhar (2020), who, based on fixed-effects regressions, also uncovers a negative (short-run) relationship between economic growth and worker remittances to Bangladesh.

As stressed by Chami, Fullenkamp, and Jahjah (2003), a negative relationship between worker remittances and economic growth can arise in case remittances lead to moral hazard. These authors note that moral hazard can manifest itself in many ways. For instance, worker remittances can have a negative impact on economic growth if remittances negatively affect total factor productivity or if they reduce active labor force participation in the home country, that is the country which receives remittances from overseas workers (also see Karagöz, 2009).

Taken together, prior empirical literature leads to contrasting findings regarding the relationship between worker remittances and economic growth. The brief literature survey in Sutradhar (2020) suggests that this inconclusiveness of results is given not only for Bangladesh but also more generally. Indeed, based on a meta-analysis of a vast number of empirical studies that investigate the relationship between worker remittances and economic growth, Cazachevici, Havranek, and Horvath (2020) conclude that while a positive relationship seems to be more likely, the positive effect is due to publication bias.[4] After correcting for publication bias the effect remains positive but it turns out to be quantitively negligible.

Cazachevici et al. (2020) also find that studies which do not control for alternative sources of external finance, notably ODA and FDI, mismeasure the growth impact of worker remittances.

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[4] Publication or dissemination bias "occurs when results of published studies are systematically different from results of unpublished studies." (Song, Hooper, & Loke, 2013, p. 71) It arises "whenever researchers, reviewers, or editors prefer certain research outcomes: for example, estimates that are in line with the prevailing theory or that are statistically significant at standard levels." (Cazachevici et al., 2020, p. 4). Cazachevici et al. (2020) apply various approaches to investigate the presence of a publication bias in the growth effect of worker remittances. They find that the positive impact given in their full dataset is reduced by up to 75 percent once publication bias is corrected for (see Cazachevici et al., 2020, pp. 4 for details).

The main motivation for the present paper is based on this latter finding. While several studies, as reported above, investigate the relationship between worker remittances and economic growth of Bangladesh, these studies do not jointly control for alternative sources of external finance. The present study aims to unveil the relationship between worker remittances and Bangladesh's economic growth provided that alternative sources of external finance are considered in the empirical model*: Is a statistical association between worker remittances and economic growth visible in official data when one jointly controls for FDI and ODA as additional sources of external finance?* Given the frequently voiced positive impact of worker remittances on economic growth, this question is of enormous policy relevance.

Contrary to most prior studies, the results presented in this paper indicate that worker remittances do not exert a significant impact on the economic growth of Bangladesh. Economic growth is mainly driven by developments in Bangladesh's capital stock and by FDI received by Bangladesh. Thus, it appears that receiving worker remittances is not a sufficient condition for increasing economic growth. This finding has implications for government policy which needs to find ways to make worker remittances more growth-friendly.

The paper is structured as follows: Section two derives the empirical model the analysis is based upon. Section three details variables and data used as well as the empirical methodology applied in the analysis. Section four includes results. The last section concludes the paper.

2. The Empirical Model

Related studies frequently derive their empirical models using a production function approach (Jawaid & Raza, 2012; Kumar & Stauvermann, 2014; Salahuddin & Gow, 2015; Olayungbo & Quadri, 2019; Coly & Mendy, 2020), which we also apply. The starting point is the following macroeconomic production function:

$$Y_t = A_t * K_t^{a} * L_t^{1-a} \quad (1)$$

where Y_t is output, L_t signifies labor input, K_t is capital stock and A_t indicates total factor productivity (TFP). Equation 1 can be rewritten in per-worker form as:

$$\frac{Y_t}{L_t} = \frac{A_t * K_t^{\alpha} * L_t^{1-\alpha}}{L_t} \quad (2)$$

or equally as $y_t = A_t * k_t^{\alpha}$ (3)

Kumar and Stauvermann (2014) introduce worker remittances (variable WR) to Equation (3) by considering TFP to be a direct function of worker remittances. This paper assumes that TFP additionally depends on FDI and ODA received. As stressed by Das et al., (2019), worker remittances could affect TFP by changing the efficiency of domestic investments. If recipients of worker remittances have superior skills in allocating capital to productive means, inflows of worker remittances improve TFP. However, remittances can have a negative impact on TFP in case receiving families' incentives to invest funds efficiently are reduced due to moral hazard (Chami et al., 2003).

Likewise, if ODA is used for improving the efficiency of domestic production, TFP will be enhanced. FDI, via backward and forward linkages, is frequently seen as an important "vehicle for transforming technology" (Barba Navaretti & Venables, 2004, p. 152), and, thus, TFP should also be enhanced by FDI inflows. We define A_t as follows:

$$A_t = A_0 * \frac{FDI_t^{\partial 1}}{L_t} * \frac{WR_t^{\partial 2}}{L_t} * \frac{ODA_t^{\partial 3}}{L_t} * \varepsilon_t \quad (4)$$

Thereby ε_t captures additional exogenous factors impacting on TFP. Substituting (4) in (3) results in:

$$y_t = A_0 * fdi_t^{\partial_1} * wr_t^{\partial_2} * oda_t^{\partial_3} * k_t^{\alpha} * \varepsilon_t \quad (5)$$

Taking logs, finally, leads to the model which forms the basis of our empirical analysis:

$$lny_t = \partial_0 + \partial_1 lnfdi_t + \partial_2 \ln wr_t + \partial_3 \ln oda_t + \alpha \ln k_t + \vartheta_t \quad (6)$$

Due to log-linearization, estimated coefficients represent elasticities. In this paper, Equation (6) is meant to capture a long-run, co-integration, relationship between the dependent variable, output per worker, and the independent variables.

3. Variables and Research Methodology

3.1. Measurements of Variables and Data Sources

Table 1 summarizes the operationalizations and the sources of the main variables included in Equation (6). Measurement of most variables and their data sources are in line with related literature. The only exception is variable capital stock (k). This variable is the sum of General government capital stock at current cost, private capital stock at current cost and public-private partnership capital stock at current cost. Data are taken from the IMF Investment and Capital Stock Dataset (2017). Values for 2016 and 2017 are extrapolated using Gross Fixed Capital Formation (GFC) data for 2016 and 2017 (GFC data are taken from World Bank's World Development Database). The sample ranges from 1990 to 2017. The sample starts with 1990 as labor force data are only available from 1990 onwards. The sample ends in 2017 due to the lack of capital stock data for more recent years.

Table 1: Measurements and Sources of Variables

Variables	Measurements	Data Source
y	GDP in current US-$ divided by total labor force	World Bank
wr	Worker remittances received in current US-$ divided by total labor force	World Bank
oda	Official development aid and assistance received in current US-$ divided by total labor force	World Bank
k	Capital stock in current US-$ divided by total labor force (1 million)	IMF
fdi	Foreign direct investment inflows in current US-$ divided by total labor force (1 million)	IMF
L	Total labor force = people aged 15+, employed or unemployed but actively job seeking	World Bank

Table 2 includes basic descriptive statistics for the variables used in the analysis, and Table 3 shows pairwise correlation coefficients. Except lnoda all variables show a strong positive correlation with lny. The high correlations of lnk and lnwr with lny are consistent with Kumar and Stauvermann (2014).

Table 2: Descriptive Statistics

	y	k	oda	wr	fdi
Mean	1637.141	2.985	34.181	108.105	78.617
Maximum	3719.205	7.843	62.073	245.579	229.379
Minimum	885.798	1.413	18.602	22.155	13.320
Observations	28	28	28	28	28

Note: k and fdi are measured as per 1 million of total labor force while the remaining variables are measured in total labor force.

Table 3: Pairwise Correlations of Variables

Variable	lny	lnk	lnoda	lnwr	lnfdi
lny	1	0.988	0.130	0.923	0.928
lnk	0.988	1	0.220	0.913	0.888
lnoda	0.130	0.220	1	-0.071	-0.154
lnwr	0.923	0.913	-0.071	1	0.946
lnfdi	0.928	0.888	-0.154	0.946	1

3.2. Autoregressive Distributed Lags Bounds Testing

Equation 6 represents a long-run, co-integration, relationship. Various approaches have been developed to estimate the coefficients of co-integration relationships. We apply the Autoregressive Distributive (ARDL) bounds testing approach developed by Pesaran, Shin, and Smith (2001) which is a standard approach to investigate the effects of worker remittances on economic growth (Das et al., 2019; Kanewar, 2018; Majumder, 2016; Kumar & Stauvermann, 2014). The bounds testing approach assumes that at most one long-run, co-integration, relationship including the dependent variable exists. Additional co-integrating relationships among the independent variables are allowed (Kripfganz & Schneider, 2018).

An advantage of the ARDL bounds testing approach is that it simultaneously estimates short- and long-run coefficients within an error-correction model. While long-run coefficients, as shown in Equation 6, represent relationships in log-levels, short-run coefficients directly represent the impact of a change in the growth rate of an explanatory variable on economic growth. A specific feature of ARDL bounds testing is its applicability to any combination of level stationary (I(0)) and first difference stationary (I(1)) variables. Variables with two or more unit roots would invalidate the procedure, however. Another advantage of ARDL bounds testing over alternative procedures is that it performs relatively well even in small samples (Philips, 2018). This property of the ARDL bounds testing approach is of importance for the application in this paper which relies on a sample with size T = 28. Philips (2018) shows that the rate of a Type I error using the ARDL bounds test is often half that of the other co-integration tests. The procedure is also robust to erroneously including an I(0) regressor. Philips (2018) concludes that, while the ARDL bounds testing approach is not without problems (see p. 14 in his paper), ARDL bounds testing "is a good test for cointegration in small samples" (Philips, 2018, p. 8).

The (unrestricted) error-correction model estimated is given in Equation (7):

$$\Delta \ln y_t = \beta_0 + \beta_1 \ln y_{t-1} + \beta_2 \ln fdi_{t-1} + \beta_3 \ln wr_{t-1} + \beta_4 \ln oda_{t-1} + \beta_5 \ln k_{t-1} + \sum_{i=1}^{n} \beta_{6i} \Delta \ln y_{t-i} + \sum_{i=0}^{n} \beta_{7i} \Delta \ln k_{t-i} + \sum_{i=0}^{n} \beta_{8i} \Delta \ln oda_{t-i} + \sum_{i=0}^{n} \beta_{9i} \Delta \ln wr_{t-i} + \sum_{i=0}^{n} \beta_{10i} \Delta \ln fdi_{t-i} + \zeta_t \quad (7)$$

where β_1 to β_5 form the basis of the long-run associations between the variables of the model. β_{6i} to β_{10i} signify short-run dynamics (Kripfganz & Schneider, 2018). Equation (7) can be rewritten as follows:

$$\Delta \ln y_t = \sum_{i=1}^{n} \beta_{6i} \Delta \ln y_{t-i} + \sum_{i=0}^{n} \beta_{7i} \Delta \ln k_{t-i} + \sum_{i=0}^{n} \beta_{8i} \Delta \ln oda_{t-i} + \sum_{i=0}^{n} \beta_{9i} \Delta \ln wr_{t-i} + \sum_{i=0}^{n} \beta_{10i} \Delta \ln fdi_{t-i} + \gamma ECT_{t-1} + \zeta_t \quad (8)$$

where ECT_{t-1} indicates the error-correction term, which represents the long-run model shown in Equation 6.

$$ECT_{t-1} = lny_{t-1} - \delta_0 - \delta_1 lnfdi_{t-1} - \delta_2 \ln wr_{t-1} - \delta_3 lnoda_{t-1} - \alpha \ln k_{t-1} \quad (9)$$

Coefficient γ is the speed-of-adjustment coefficient which captures how quickly the long-run equilibrium is re-established after the occurrence of disequilibrating shocks. Importantly, for co-integration between variables, coefficient γ must be negative, lie between 0 and 1 (in absolute value) and must be statistically significant at conventional levels. The distribution of the t-statistic is non-standard (Philips, 2018).

As mentioned, one advantage of the ARDL bounds testing approach is that variables can be any combination of I(0) and I(1) variables. The existence of a long-run relationship between variables is established based on lower and upper bound critical values derived by Pesaran et al. (2001). Specifically, the lower bounds impose the restriction that all variables are I(0) and the upper bound imposes the restriction that all variables are I(1). The null hypothesis of absence of co-integration is rejected if the calculated F-statistic is larger than the upper bound critical value. In case the F-value is smaller than the lower bound critical value, the null hypothesis is not rejected. In case the calculated F-statistic lies between the upper and the lower bound, the test is inconclusive (Das et al., 2019; Philips, 2018).

The null hypothesis of no co-integration is tested using an F-test. The test is based on Equation 7 with null and alternative hypotheses as follows:

H0 (no co-integration): $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$

H1 (co-integration): $\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq 0$

From equation (7) we see that under the null hypothesis variables in levels vanish from the equation. Put differently, only variables in first differences remain and co-integration, which is a level concept, is absent (Pesaran et al., 2001).[5]

Like the distribution of the t-test on the significance of the speed-of-adjustment coefficient (γ), the distribution of the F-test statistic is non-standard. Inter alia the distribution depends on the order of integration of the independent variables (Kripfganz & Schneider, 2018). Asymptotically valid bounds on the critical values are provided by Pesaran et al. (2001) and for small samples by Narayan (2005).

[5] As advised by Pesaran et al. (2001, p. 304) in case H0 is rejected it is useful to t-test whether the coefficient on the speed-of-adjustment coefficient (γ) is statistically different from zero.

The validity of the ARDL bounds testing approach relies on normally distributed, homoscedastic and serially uncorrelated errors. In addition, coefficients need to be stable over time (Das et al., 2019; Kripfganz & Schneider, 2018). Therefore, it is important to supplement ARDL bounds testing by a series of tests that investigate the statistical properties of regression errors and regression coefficients.

ARDL bounds testing is done in several steps (also see Das et al., 2019). First, tests for unit roots in variables are conducted. Second, if all variables are at most I(1), an optimal ARDL model with appropriate lag length is chosen. The appropriate lag length is selected so that the error term of the ARDL model does not show signs of serial correlation (Altintas & Taban, 2011; Kanewar, 2018). Third, based on the optimal ARDL model, bounds testing is carried out. Fourth, if the null hypothesis of no co-integration is rejected, Equations 6 and 8 are estimated. Diagnostic testing and testing for parameter stability are done in a fifth step.

4. Results and Discussions

4.1 Unit Root Tests

We test for the presence of unit roots using the Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1979) and the Phillips and Perron (PP) test (Phillips & Perron, 1988). ADF and PP tests, which test the null hypotheses of a unit root, indicate that each variable is stationary in first differences (at the 5% significance level). Thus, a pre-condition for using ARDL bounds testing is fulfilled (see Table 4). Note that we can remain agnostic about stationarity at levels as ARDL bounds testing can be applied to any combination of I(0) and I(1) variables. For choosing the appropriate lag length of the ADF test the Akaike Information Criterion (AIC) and the Schwarz Information Criterion (SIC) are applied. Both information criteria select the same lag length. For the PP-test the Newey-West bandwidth selection is used. As variables show a trend in levels, the estimating equations in first differences include a constant.

Table 4: ADF and PP Unit Root Tests

Variable	H0	ADF test	PP Test
lny_t	I(2)	-3.28**	-3.23**
lnk_t	I(2)	-5.38**	-5.38**
$lnoda_t$	I(2)	-5.28***	-18.73***

$lnwr_t$	I(2)	-3.12**	-3.48**
$lnfdi_t$	I(2)	-2.16**	-2.18*

Notes: *, **, *** indicate levels of significance at 10%, 5% and 1%. Tests and estimations are conducted using E-views 10.

4.2 Lag Length Selection

The AIC and the SIC are frequently used to isolate the appropriate lag length. In this study it is assumed that the maximum lag length is 3, which is approximately $T^{\wedge 1/3}$ (Maddala & Kim, 1998, p. 76; T is 28). As shown by Table 5, AIC and SIC result in conflicting recommendations. As it is crucial that the regression errors do not show any signs of serial correlation, a LM-Test for the presence of serial correlation is conducted at each lag length. The null hypothesis of no serial correlation is not rejected at lag one. Based on the SIC and the LM test, lag one is chosen as appropriate.

Table 5: Lag Length Selection

Lag	AIC	SIC	LM-Test (p-Value)	H_o (no serial correlation)
1	-11.275	-9.812*	0.443	Accepted
2	-11.059	-8.377	0.000	Rejected
3	-13.516*	-9.615	0.000	Rejected

Note: Information criteria are calculated based on the same number of observations.

4.3 ARDL Model Estimation

Given the appropriate lag length of one, a model selection graph is used to choose the optimal ARDL model. ARDL (1, 1, 0, 0, 1) comes out with the lowest AIC and SIC values and, thus, is chosen as optimal (see Table 6).

Table 6: Selected ARDL Model: ARDL (1, 1, 0, 0, 1)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
lny_{t-1}	0.249	0.176	1.413	0.173
lnk_t	0.291	0.104	2.779	0.011
lnk_{t-1}	0.296	0.146	2.022	0.057
$lnoda_t$	-0.034	0.036	-0.935	0.361
$lnwr_t$	-0.029	0.032	-0.911	0.373

$lnfdi_t$	0.204	0.071	2.854	0.010
$lnfdi_{t-1}$	-0.127	0.056	-2.268	0.035
Constant	14.052	3.288	4.273	0.000
R^2	0.996	Mean dependent var		7.314
Adjusted R^2	0.994	S.D. dependent var		0.442
F-statistic	715.522	Durbin-Watson stat		2.159
Prob(F-statistic)	0.000			

4.4 ARDL Bounds Testing

The results from ARDL bounds testing are provided in Table 7. The F-statistic of 6.4 is larger than the critical values derived by Narayan (2005) at conventional significance levels. ARDL bounds testing, therefore, is consistent with the existence of a co-integration relationship between the dependent and the independent variables.

Table 7: ARDL Bounds Test

Test Statistic	Value	Sig.	I(0)	I(1)
F-statistic	6.393	10%	2.2	3.09
m	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Note: m = number of independent variables included.

4.5 Long-Run Relationship

Table 8 indicates that the log-level of GDP per worker is statistically related to the log-level of capital stock per worker and the log-level of FDI inflows per worker. Both elasticities are positively signed. A one percent increase in capital stock per worker leads to an increase of GDP per worker of about 0.78 percent in the long run. The estimated value for the share of capital in income of 78 percent is higher than the share reported by Sinha (2017) (about 50 percent) and the share estimated by Kumar and Stauvermann (2014) (about 33 percent). An increase of FDI inflows per worker by one percent increases the dependent variable by about 0.1 percent. In contrast, ODA per worker and worker remittances per worker are statistically unrelated to GDP per worker in the long run. The findings regarding lnwr contrast with most related studies which tend to find a significant positive long-run relationship. Exceptions in this respect are Salma (2019) and Shimul (2013) who also report a statistically insignificant long-run association.

Table 8: Long-Run Coefficients (Equation 6)

Variable	Coefficient	Std. Error	t-Statistic	p-Value
lnk_t	0.781	0.069	11.217	0.000
$lnoda_t$	-0.045	0.049	-0.912	0.373
$lnwr_t$	-0.039	0.038	-1.010	0.325
$lnfdi_t$	0.102	0.039	2.600	0.017
Constant	18.720	0.959	19.507	0.000

4.6 Short-Run Relationship (Equation 8)

Estimation results for Equation (8) are shown in Table 9. Mechanically, the coefficients on the first differenced variables in Table 9 are equal to the coefficients of the contemporaneous (non-lagged) variables in Table 6. Thus, in the short run, economic growth is positively related to growth in capital stock and growth in FDI inflows. A one percentage point increase in the growth rate of capital stock per worker is tied to a 0.29 percentage point increase in the economic growth rate. Likewise, a one percentage point increase in the growth rate of FDI inflows increases the economic growth rate of Bangladesh by 0.24 percentage points. Growth in ODA per worker and in WR per worker do not statistically impact on short-run economic growth.

The coefficient of ECT, the speed-of-adjustment coefficient, is negative and the t-statistic is larger (in absolute value) than -4.60 which implies the rejection of the null hypothesis of no co-integration at the 1% significance level (see Pesaran et al., 2001, p. 303, for tabulated values). The absolute value of γ is between 0 and 1, which is also consistent with co-integration. The value of 0.75 indicates that after a disequilibrating shock, 75 percent of the deviation from the long-run equilibrium will be corrected within one year. The estimated speed of adjustment is faster than established by the studies of Parveen, Masuduzzaman, Islam, and Dipty (2019), Kumar and Stauvermann (2014) and Shimul (2013), but slower than the adjustment speed isolated by Majumder (2016).

Table 9: Short-Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Δlnk_t	0.291	0.066	4.515	0.000
$\Delta lnoda_t$	-0.034	0.036	-0.935	0.361
$\Delta lnwr_t$	-0.029	0.032	-0.911	0.373
$\Delta lnfdi_t$	0.240	0.039	5.216	0.000
ECT_{t-1}	-0.750	0.108	-6.961	0.000
R^2	0.764	Mean dependent var		0.051
Adjusted R^2	0.744	S.D. dependent var		0.055
Log. Likelihood	59.526	Durbin-Watson stat		2.159
S.E. of Regression	0.028			

4.7 Diagnostic Testing and Parameter Stability Test

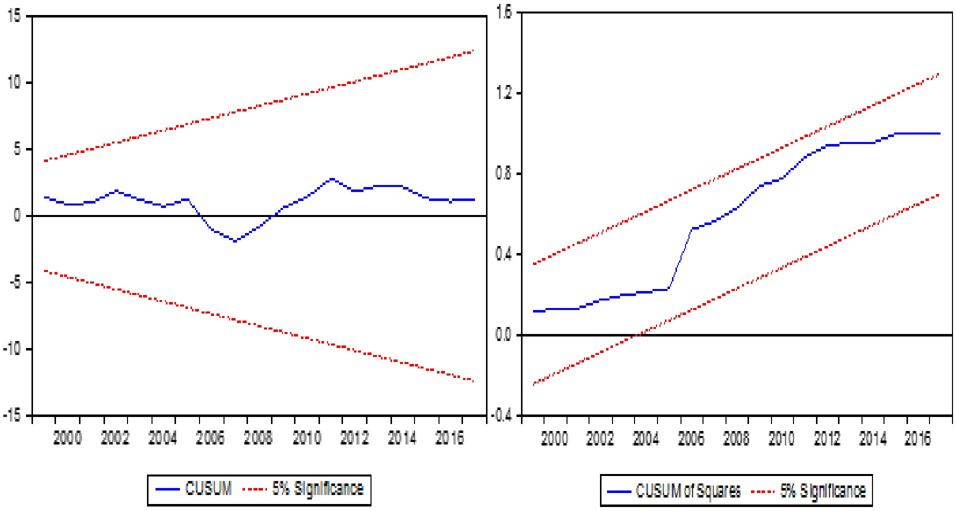
Table 10 includes results of several diagnostics tests. Errors of the chosen ARDL model (see Table 6) are statistically well behaved and the Ramsey RESET test does not indicate any issues with functional form misspecification.

Table 10: Diagnostics Tests

Test	H0	p-value
Normality Test (Jarque-Bera)	Normal Distribution	0.268
Serial correlation LM Test (Breusch)	No serial correlation	0.4433
Heteroskedasticity Test (Breusch)	Homoscedastic errors	0.588
RESET Test (Ramsey)	No Functional Form Misspecification	0.481

Parameter stability is investigated using the Cumulative Sum of Recursive Residuals (CUSUM) and the CUSUM of Squares for lny (see Figure 1). The graphs indicate parameter stability.

Figure 1: CUSUM and CUSUM of Squares for lny



5. Summary and Conclusions

Worker remittances are perceived to be an important tool to increase economic growth of receiving countries. Bangladesh is not an exception. Yet, prior empirical literature is inconclusive regarding the impact of worker remittances on Bangladesh's economic growth. Moreover, available studies likely suffer from an omitted variables bias in so far as they do not jointly control for additional sources of external finances, Foreign Direct Investment (FDI) and Official Development Aid (ODA) in particular.

This neglect of additional external sources of finances is the point of departure of the current study. The paper investigates within an error-correction framework the impact of inward worker remittances on Bangladesh's economic growth. The empirical model jointly considers FDI inflows and ODA as additional sources of external finances. The empirical analysis is based on 28 years of annual data and on the ARDL bounds testing approach, which has been shown to perform relatively well with samples of small sizes. Findings indicate that worker remittances have no impact on economic growth of Bangladesh. According to our empirical analysis, economic growth is mainly driven by capital stock accumulation and by developments in FDI inflows.

The neutrality of worker remittances with respect to economic growth of Bangladesh is consistent with either of the following arguments. First, worker remittances do just not matter for economic growth, an interpretation which is broadly consistent with the findings of Cazachevici et al. (2020). This interpretation is also consistent with evidence on the actual usage of remitted funds.

A survey conducted by the Bangladesh Bureau of Statistics (see Hussain, 2014) hints towards the possibility that a substantial share of remittances received is not directly invested, which reduces their potential growth effect. This finding is corroborated by the recent study of Raihan, Uddin, and Sakil (2021) who show that worker remittances have a positive and significant impact on the amount spent on many spending categories (especially health, food, consumed and durable goods, housing and land) with the notable exceptions of education and investment.

Second, neutrality may arise because the positive and the negative economic growth effects of worker remittances (as briefly sketched in Section 1) balance each other. Thus, worker remittances do have an impact on economic growth, yet positive and negative effects are of equal importance. This possibility deserves further academic scrutiny, especially a thorough investigation into moral hazard effects of worker remittances would be valuable.[6]

Third, worker remittances do matter for economic growth, but their effect is captured by developments in Bangladesh's capital stock. This argument rests on the assumption that worker remittances are a main contributor to capital investments in Bangladesh. However, as sketched above, recent surveys and studies do not support this interpretation.

It is important to stress that despite worker remittances do not exert a positive impact on the economic growth of Bangladesh (either no effect at all or no positive net-effect), this finding does not mean that worker remittances do not fulfill key economic purposes. Worker remittances certainly help the receiving families to fund their consumption expenditures. Indeed, worker remittances help to improve nutrition, living conditions or housing of receiving Bangladeshi households. Remittances add to poverty reduction not least as the main receivers of worker remittances are households headed by females with very low levels of education and low ownership of property (Barai, 2012a; Barai, 2012b; Hussain, 2014).

But from the paper it follows that worker remittances could be used in ways that more strongly contribute to economic growth and, in turn, to economic development. Specifically, investments in physical and human capital, funded via worker remittances, need to gain in importance. To that end, government intervention is justified. For example, the government could create public awareness regarding the proper usage of remitted funds. The government could encourage – and help – remittance-receiving families to save and invest their money through small or

[6] Hussain (2014, p. 2) asserts that the existing evidence suggests that moral hazard effects are "weak at best, if not absent."

family-based businesses. This way, worker remittances can create job opportunities that are in urgent need by vastly populated developing countries like Bangladesh. Besides, the government could incentivize remittance-receiving families to invest the remitted money on the capital market and on other income-generating sources by establishing a stable macroeconomic environment. Thus, while worker remittances are certainly important for receiving families, their economic growth impact needs to be spurred by incentivizing a more economic growth-conducive usage of remitted funds.

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