Journal of Economics and Sustainable Development www.iiste.org
ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online) DOI: 10.7176/JESD
Vol.10, No.6, 2019

Aid-growth Nexus in Bangladesh: An Evidence from the ARDL Bound Testing Approach

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Abstract
The debate on the aid-growth nexus isn't a new one. This much heated issue has received a good deal of empirical coverage for the time series data of Bangladesh. In this study we have revitalized the old debate to minimize existing literature gaps on the aid-growth nexus in Bangladesh. We have employed ARDL bound testing approach to examine the nature of relationship between aid and economic growth in Bangladesh. In the long run per capita foreign aid positively influence per capita gross national income. It exerts the same effect in short run too. In long run a 1 percent increase in per capita aid leads to 0.27 percent increase in per capita gross national income and in short run 10 percent increase in aid per capita increases per capita gross national income by 0.54 percent. A positive effect from the policy variable has also been obtained which justifies the implementation of pro trade liberalization policy in the post liberation-war period.
Keywords: official development assistance, economic growth, cointegration, ARDL bound testing
DOI: 10.7176/JESD/10-6-17
Publication date:March 31st 2019

1. Introduction:

The economy of Bangladesh is characterized as robust and resilient. Defeating many downfalls, she manages to come back on track exerting sheer economic strength and flexibility. Bangladesh was the second fastest growing economy in 2016 registering a boastful 7.1percent GDP growth. The country has opened its economy to the world market gradually after the independence in 1971. Major reforms around 1980s and 1990s have rightfully awarded her with an average 5.41 percent annual GDP growth since 1991[1]. Right after the independence in 1971 the country was considered a basket case owing to the fact that it lacked major infrastructural setup to operate its economy in a normal momentum. Predictably, Bangladesh had to take aid from the donors to overhaul its broken economy and feed a bigger portion of its population who had suddenly become poor and malnourished from the blood-stained liberation war. With the passage of time, Bangladesh has taken some major social and economic strides and achieved sheer successes. The country has already obtained food self-sufficiency. Life expectancy and school enrollment in all segments of education have significantly improved. Success in achieving MDGs is outstanding compared with many developing nations. Given this state of the economy it is natural to ask what role official development assistance (ODA) has played so far on the economic growth of the country. Bangladesh has been an ODA recipient country since its independence in 1971. The aid receipts are mainly intended for filling internal and external deficits, financing annual development program (ADP), eradicating poverty, recovering the losses from natural calamities etc. Donor countries which are in principle developed nations provide aid for non-commercial uses by the recipient countries. Foreign aid is generally characterized by concessional terms which are soft in nature. Aid in Bangladesh comes in the form of loans, grants, food aid, commodity aid and project aid etc.

In Bangladesh aid-growth nexus has received a good deal of empirical coverage. Analyzing the existing literature, one cannot simply overlook the apparent inadequacy in estimations carried out in this respect. In many cases, time series data were not fully utilized to address the existence of cointegration that might have shed light on the long run nature of the relationship between foreign aid and economic growth. The purpose of this paper thus, is to analyze the long run effect of official development assistance on economic growth in Bangladesh. We make use of auto regressive distributed lag (ARDL) bound testing approach to estimate a long run model for aid-growth nexus in Bangladesh. The next section provides a brief discussion on foreign aid scenario in Bangladesh. Then we survey existing literature on aid-growth nexus. The subsequent sections will discuss on the data, methodology and model specification. Then we provide the analysis of results and concluding remarks.

2. Foreign Aid Scenario in Bangladesh

One of the major long-term development plans of Bangladesh is to achieve the goal of graduating to middle-income country by 2021. The government has formulated the 7th five-year plan where key focus has been concentrated on increasing the share of investment in GDP by 34.4 percent. A portion of the investment demand is projected to be filled up by foreign aid. Between the FY2013-14 and FY2017-18 commitment of foreign aid

[1] Author's calculation from the Penn World Table Data 9.0

was USD 50.73 billion and disbursement USD 19.85 billion. FY2017-2108 alone witnessed a record aid disbursement of USD 6.29 billion.

Aid dependency is dropping as government spending evidently has outpaced foreign aid in several fiscal years. Aid financed about 48% of annual development program (ADP) in 2009-10 which declined to 27 percent in 2015-16. Tax revenues have now become the major source of public spending. Tax revenue as percentage of GDP has been around 10 percent in the last decade as opposed to 2 percent of foreign aid as percentage of GDP.

Table:1

Changing Pattern of Flow of External Economic Assistance 1972-2017

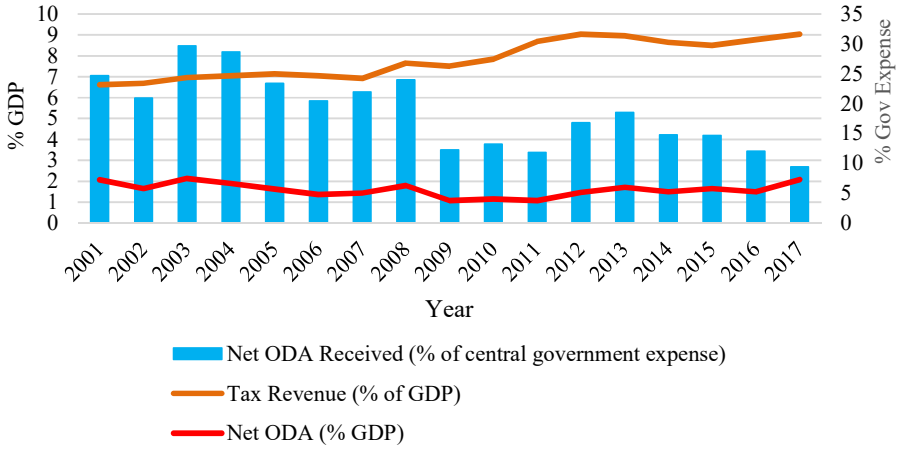
Time Period	Total Assistance (US $ Million)	Type			Nature		Source	
		Food Aid (%)	Commodity Aid (%)	Project Aid (%)	Loan (%)	Grant (%)	Bilateral (%)	Multilateral (%)
1971-73	822	38	52	10	11	89	71	29
1973-78	3531	35	42	23	58	42	75	25
1978-80	2253	25	38	37	49	51	72	28
1980-85	6101	20	35	45	46	54	65	35
1985-90	8020	14	29	57	57	43	55	45
1990-96	9761	11	22	67	51	49	49	51
1996-00	5857	9	17	74	55	45	45	55
2000-04	5430	3	10	87	66	34	52	48
2004-07	4687	4	0.5	95	72	28	73	27
2007-12	10077	4	0.0	96	67	33	75	25
2012-17	16371	1	0.0	99	81	19	35	65

Source: Flow of External Resources in Bangladesh, Economic Relations Division, Ministry of Finance

Between the fiscal year 2013-14 and 2017-18 the lion's share of total aid receipts came in the form of project aid. Table 1 produces the breakdown of official development assistance received over the year 1972 to 2017. It can be seen from there that over the time project aid has become bigger in size compared with food aid and commodity aid. This is understandable from the fact that the country is witnessing huge infrastructural development where donors are actively playing a promising role. Surge of project aid has given rise to USD 44 billion of foreign aid in pipeline as of FY2018-2019. Efficiency in project implementation may accelerate the pace of ultimate utilization of this huge aid.

Figure 1 reflects the present scenario of aid dependency for financing government expenses in Bangladesh. ODA as percentage of central government expense has been gradually decreasing since 2001. On the other hand, tax revenue as percentage of GDP has been generally rising since 2001. In 2017 tax revenue (% GDP) was 9.03 percent and net ODA received as a share of central government expense was 9.39 percent. This was 24.65 percent in the year 2001.

Figure 1: Presesnt Situation of Aid Dependency in Bangladesh



Source: World Development Indicator 2017

3. Literature Review

Literature on the foreign aid-growth nexus consists of mainly two differing views. Traditional pro aid view and radical anti-aid view. Both groups of proponents produce theoretical and empirical results in favor of their viewpoints. Early growth theorists contend that developing nations may require a right quantity and mixture of investment, saving and foreign aid to achieve higher growth like that of developed nations (Todaro 2015). Foreign aid provides a foreign exchange deficient country with foreign exchange that not only enhances its utilization of domestic resources but also bring enough technological improvements in its production process which leads to a higher growth (Chenry and Strout, 1966; Papanek, 1973). Cross country evidence gathered by Burnside and Dollar (2000, 2004) strengthens the idea of allocation decision made by the donor and overall effectiveness of foreign aid in the presence of good policy in the recipient country. On the other hand, proponents of anti-aid view mostly argue that foreign capital in the form of aid distorts domestic capital formation scenario which makes the recipient country experience a less or no growth. Proponents of anti-aid view also suggest that foreign aid may give rise to inequal income distribution, import of unnecessary wasteful technology, appropriation of resources by corrupt government body, displacement of domestic investment by increasing domestic consumption (Griffin, 1970; Griffin and Enos, 1970; Weisskoff, 1972a, b; Boone 1996). Rajan and Subramanian (2008) also find no systematic positive relationship between aid and growth in cross country level.

Aid-growth nexus in the perspective of Bangladesh has received considerable empirical coverage and the findings are in no common consensus like existing mainstream aid literature. For example, Alamgir (1974) reports a negative aid-growth relationship. Rahman (1984) in a two-sector model finds aid to be positively influencing economic growth in Bangladesh over the period 1972-82. Ahmad (1990) corroborates this finding for the data over 1961-1980. Islam (1992) disaggregates total aid data for Bangladesh over the period 1972-88 into grants and loans and reports that grants negatively affect growth while loans positively influence growth in Bangladesh. Quazi (2000) finds that foreign aid reduces GDP growth in Bangladesh. Quibria (2007) opines that success of aid in Bangladesh is mixed and he questions the role of both donor and government in this respect. Hossain (2014) extensively examines the role of foreign aid on the economic growth in Bangladesh over the period 1980-2012 by making use of a set of aid-growth model to capture the effect of aid on growth during different political regimes. He finds an overall positive aid-growth nexus in Bangladesh but reports that aid exerts a decreasing-returns due to domestic capacity constraints.

4. Data and Methodology

The time series data used in this study are annual and range the period 1981 to 2016. The data series are collected from World Development Indicator 2017. This paper makes use of the recently developed ARDL bound testing approach to cointegration for the estimation of the model. Bound testing approach to cointegration is constructed within the widely used ARDL (auto regressive distributed lag) framework by Pesaran and Shin (1995); Pesaran and Pesaran (1997) ; Pesaran et al (2001) which needs not take into account the underlying property of time series data that may be entirely I(0), entirely I(1) or jointly cointegrated i.e. in the presence of time series data which are an admixture of I(0) and I(1) series, it is possible to look for long-run and short-run dynamics upon having a favorable bound testing result about the cointegration test. ARDL approach to cointegration doesn't require pretesting the variables. That is, ARDL approach to testing for the existence of a relationship between variables in levels is applicable regardless of whether the underlying regressors are purely I(0), purely I(1) or mixture of both.

There are advantages in using ARDL approach to cointegration over conventional Johansen (1998), Johansen and Juselius (1990) approach. Johansen cointegration method requires a system of equations to estimate long-run relationship while ARDL cointegration approach requires only a single equation set-up (Pesaran and Shin, 1995). ARDL approach to cointegration is unbiased and efficient. It performs well in limited sample size such as in our analysis. In this particular case critical values of F statistic developed by Narayan (2004) to analyze bound testing result should be used instead of F-Statistic tabulated by Pesaran et al. (2001). Because Pesaran's F-Statistic seems to overestimate the presence of cointegration in small sample (30 observations to 80 observations) analysis. Finally, the flexibility in assigning different optimal lag values for different variables makes the ARDL approach to bound testing even more enticing.

ARDL approach to cointegration involves mainly two steps to complete the whole task of estimation. First, without having prior knowledge about the direction of long run relationship among the variables, a conditional or unrestricted error correction model (ECM) in ARDL framework is formulated and estimated with optimal lag structure. The estimation provides a F-statistic value which we use to perform bound testing to get a confirmation about the existence of cointegration or long run relationship among the variables. Second, a long run "level-model" as well as a separate restricted ECM is estimated having a favorable test result about cointegration in the first step. Thus, we obtain long run equilibrating relationship and short run dynamics from the estimated coefficients of 'level-model' and restricted ECM respectively.

The order of the lag in ARDL model is taken as per the suggestion of Pesaran and Shin (1998) and Narayan (2004). According to both, maximum two orders of lags should be kept for the variables in annual data series. As

our data is annual that spans from the period 1981 to 2016, we go in line with them. Based on the theoretical underpinnings and empirical reviews we set out to estimate the basic growth function of below type.

$$lnGNIpc_t = b_0 + b_1 lnK_t + b_2 lnPOP_t + b_3 lnOPN_t + b_4 lnODApc_t * lnOPN_t + b_5 lnODApc_t + u_t \quad (1)$$

Here, ln denotes natural logarithm. $GNIpc$ and $ODApc$ represent per capita gross national income and per capita net official development assistance received. We have used export to GNI ratio to proxy country's openness to global trade. Finally, to measure the interaction of policy and aid on growth in the light of neoclassical model, an interaction term between openness and official aid is included in the model. The rationale behind keeping the openness variable in the policy measure is it not only captures the country's openness to trade but also captures the effect of a favorable trade liberalization policy which Bangladesh has been adopting since early 1980s.

With no prior knowledge about the presence of long-run relationship among the variables, we estimate equation (2), a conditional error correction version of ARDL model for our basic growth equation stated in (1).

The F-test dedicated to Bound Test indicates the existence of long run relationship. The null hypothesis for "no cointegration" in equation above is $H_0: \lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = \lambda_5 = \lambda_6 = 0$ against the alternative hypothesis, $H_a: \lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq \lambda_5 \neq \lambda_6 \neq 0$. The test generates two sets of critical values, $I(0)$ or, lower bound and $I(1)$ or, upper bound critical values at different significance level. If the computed F-test statistic exceeds upper bound we can conclude that a long run level relationship exists between variables. If it lies below upper bound, null hypothesis of no cointegration cannot be rejected. In the case of a computed value lying between lower and upper critical bound decision about long run relationship remains unsettled.

$$\Delta lnGNIpc_t = \alpha_1 + \sum_{i=1}^{n} \delta_i \Delta lnGNIpc_{t-i} + \sum_{i=0}^{n} \gamma_{1i} \Delta lnK_{t-i} + \sum_{i=0}^{n} \gamma_{2i} \Delta lnPOP_{t-i} + \sum_{i=0}^{n} \gamma_{3i} \Delta lnOPN_{t-i} + \sum_{i=0}^{n} \gamma_{4i} \Delta (lnOPN * lnODApc)_{t-i} + \sum_{i=0}^{n} \gamma_{5i} \Delta lnODApc_{t-i} + \lambda_1 lnGNIpc_{t-1} + \lambda_2 lnK_{t-1} + \lambda_3 lnPOP_{t-1} + \lambda_4 lnOPN_{t-1} + \lambda_5 (lnOPN * lnODApc)_{t-i} + + \lambda_6 lnODApc_{t-1} + \varepsilon_t \quad (2)$$

Upon having a positive result about the presence of cointegration as indicated by a computed F-test value which lies above $I(1)$ critical bound values. We proceed to estimate the following long run equations (also known as level-form equations) stated in (3):

$$lnGNIpc_t = \theta_1 + \sum_{i=1}^{n} \beta_{1i} lnGNIpc_{t-i} + \sum_{i=0}^{n} \beta_{2i} lnK_{t-i} + \sum_{i=0}^{n} \beta_{3i} lnPOP_{t-i} + \sum_{i=0}^{n} \beta_{4i} lnOPN_{t-i} + \sum_{i=0}^{n} \beta_{5i} (lnODApc * lnOPN_{t-i}) + \sum_{i=0}^{n} \beta_{6i} lnODApc_{t-i} + w_{2t} \quad (3)$$

In addition to the long run estimates we will have the short run dynamics for our models by formulating the below equation stated in (4) within the ARDL framework:

$$\Delta lnGNIpc_t = b_0 + \sum_{i=1}^{n} \delta_i \Delta lnGNIpc_{t-i} + \sum_{i=0}^{n} \gamma_{1i} \Delta lnK_{t-i} + \sum_{i=0}^{n} \gamma_{2i} \Delta lnPOP_{t-i} + \sum_{i=0}^{n} \gamma_{3i} lnOPN_{t-i} + \sum_{i=0}^{n} \gamma_{4i} (lnODApc * lnOPN)_{t-i}) + \psi_1 ECM_{t-1} + v_{3t} \quad (4)$$

In the above equations ECM is the error correction term. The coefficient of ECM term shows how much of the disequilibrium is corrected in each period.

5. Analysis of the Results

ARDL approach to cointegration doesn't require pretesting the unit root of underlying series. Because, it can detect the existence of cointegration without knowing the order of integration among variables. But to avoid spurious results, it is safe to perform unit root tests for all variables and confirm none of the underlying variables are $I(2)$. Here, we have made use of augmented Dickey-Fuller and Phillip Perron test to test for the presence of unit roots.

Table 2 provides the unit root test results. All of the variables when first differenced produce test statistics that exceed the critical test statistic in absolute terms. This confirms that all the variables are $I(1)$ or, stationary in their first-differences.

Based on the findings in unit root tests, in the next step, equation (2) is estimated to check whether a long run relationship or cointegration exists among variables. As discussed above, we keep the maximum lag orders to two i.e. $i = 2$ in our models as all the series involved here are annual. Then the optimal number of lags are selected based on the Akaike info criterion (AIC). the lag length that minimizes AIC is found to be $ARDL(2, 0, 1, 0, 0, 1)$.

Table: 2

Unit Root Test Results

Variables	ADF Statistics	1% Critical Value	5% Critical Value	PP Statistics	1% Critical Value	5% Critical Value
$lnGDPpc_t$	-0.683745	-4.252879	-3.548490	-1.043055	-4.243644	-4.243644
$\Delta lnGDPpc_t$	-4.407478	-4.252879	-3.548490	-4.462049	-4.252879	-3.548490
lnK_t	-3.766692	-4.339330	-3.587527	-1.522516	-4.243644	-3.544284
ΔlnK_t	-5.901600	-4.252879	-3.548490	-5.921839	-4.252879	-3.548490
$lnpop_t$	-2.372711	-2.653401	-1.953858	7.996426	-2.632688	-1.950687
$\Delta lnpop_t$	-2.274454	-2.641672	-1.952066	-3.033234	-2.634731	-1.951000
$lnODApc_t$	-1.677974	-3.632900	-2.948404	-1.570012	-3.632900	-2.948404
$\Delta lnODApc_t$	-8.084493	-3.639407	-2.951125	-8.031326	-3.639407	-2.951125
$lnopn_t$	-2.140551	-4.243644	-3.544284	-2.289818	-4.243644	-3.544284
$\Delta lnopn_t$	-4.585753	-4.252879	-3.548490	-4.593975	-4.252879	-3.548490

The calculated F-statistic and critical values of lower bound and upper bound are reported in the table 3. The computed F-statistic (8.691646) is higher than the upper bound critical value $I(1)$ at the 1 percent significant level. This implies that the null hypothesis of no cointegration cannot be accepted and there exists a long run relationship among variables.

Table: 3

F Statistics for Cointegration Relationship

Test Statistic	Value	Significance	$I(0)$	$I(1)$
F-statistic	8.691646	10%	2.08	3
		5%	2.39	3.38
k	5	2.5%	2.7	3.73
		1%	3.06	4.15

We estimate the long run or level form relationship among the variables after the existence of cointegration has been confirmed. Table 4 reports the results. Gross capital formation exerts a strong positive long run effect on country's growth as indicated by its significance at the 1 percent level. A 1 percent increase in gross capital formation leads to 0.49 percent increase in per capita gross national income. Growth of population shows a negative long run effect on growth as expected. Country's openness enters with a negative sign but the coefficient is insignificant.

The interaction term appears with a positive sign and is significant at the 10 percent level. This denotes two things. Official development assistance and openness reinforces effect of each other on country's economic growth and justifies the contribution of a good policy to economic growth. Bangladesh has undertaken massive liberalization policy reform since 1980. Robust yet pragmatic policy reforms specially in trade sector have rightfully awarded the country to realize benefits from official development assistance.

Table: 4

Long-run Model for ODA-growth Relationship

	Independent Variable				
	lnK	$lnpop$	$lnopn$	$lnopn * lnodapc$	$lnodapc$
Dependent Variable ($lnGNIpc$)	0.493229* (0.112028)	-1.215298* (0.334119)	-0.113566 (0.113081)	0.064629*** (0.043272)	0.265041** (0.125603)

Notes: standard error in parentheses
*** significant at the 10% and below
** significant at the 5% and below
* significant at the 1% and below

Finally, official development assistance per capita enters with a positive sign and the estimated coefficient is significant at the 5 percent level. In the long run, a 1 percent increase in per capita official development leads to 0.27 percent increase in per capita gross national income. This finding is consistent with many past empirics that involve both cross-country and individual country level data.

Short run effects of the variables are reported in the Table 5. The effect of population growth on per capita gross national income growth in the short run is negative and significant. Per capita official development exerts a strong positive effect on per capita GNI in the short run too. A 10 percent increase in ODA leads to 0.54 percent increase in per capita GNI in the short run.

Table: 5

Short-run Model for ODA-growth Relationship		
Dependent Variable: GNI per capita		
Independent Variables	Co-efficient	Std. Error
$\Delta lnGNIpc_{t-1}$	-0.210613	0.131291
$\Delta lnPOP_t$	-8.197249*	0.974807
$\Delta lnODApc_t$	0.054358*	0.008304
ECM_{t-1}	-0.210323*	0.024118

*Significant at the 1% level

The coefficient of error correction term ECM_{t-1} is negative and highly significant at the 1 percent level. Negative sign ensures the process is converging and the statistical significance guarantees a long run equilibrium. The coefficient is -0.21 implying that a 21 percent disequilibrium in the current period gets corrected in the next period. More intuitively, once shocked the system requires about 4.8 years to get back to the long run equilibrium.

6. Conclusion

In this study we have analyzed the effect of official development aid on economic growth in Bangladesh. Aid in both short and long run exerts a significant positive effect on economic growth thus confirming a positive aid-growth nexus in Bangladesh. In short run a 10 percent increase in per capita aid leads to 0.54 percent increase in per capita gross national income and in the long run a 1 percent increase in per capita aid leads to 0.27 percent increase in per capita gross national income. The significant interaction term also provides a valuable information on the necessity of maintaining good economic policy to capture benefits from external resources flowing in the country. Though our empirical findings extend support for foreign aid, policies must be formed to reduce dependency on it. Domestic savings must be encouraged. Tax system should be made stronger to finance domestic investment and public expenditure. Export sector must receive extra care to circumvent foreign exchange constraint. In conjunction with these, domestic capacity must be enhanced to utilize flow of aid which will in turn, lessen the future dependency on it.

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